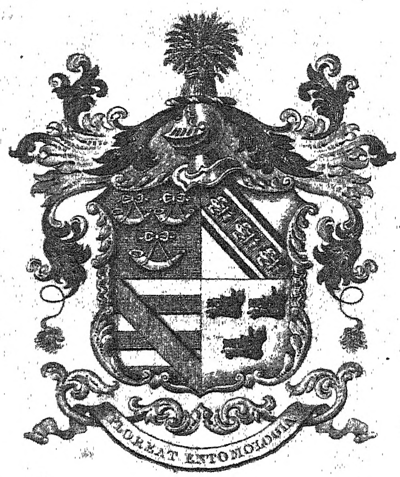

J. C. DALE, M.A., F.L.S., F.C.P.S., &c.

GLANVILLE'S WOOTTON,

HIGH SHERIFF FOR DORSET 1843.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'MAGAZINE OF BOTANY AND ZOOLOGY,' AND OF LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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AND
RICHARD TAYLOR, F.L.S., F.G.S.

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1847.

"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

. . . . the sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

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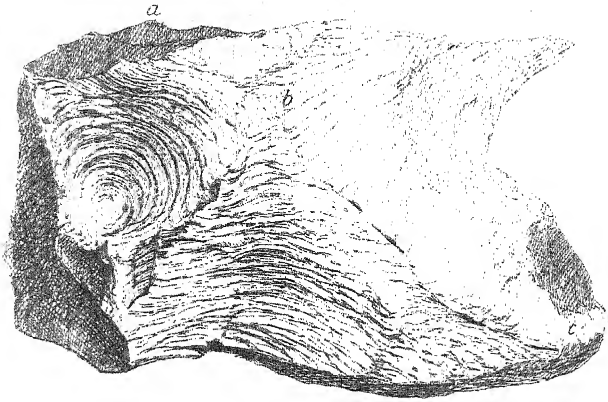

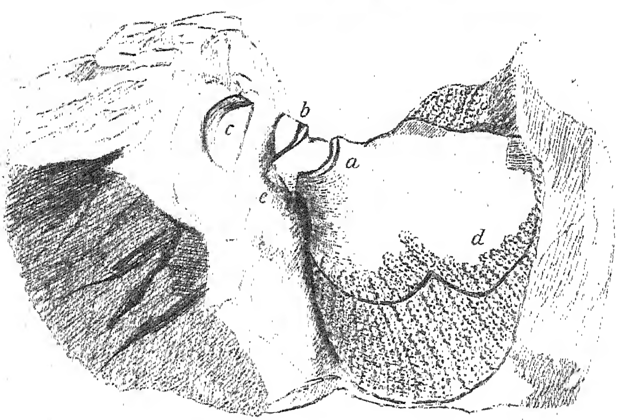

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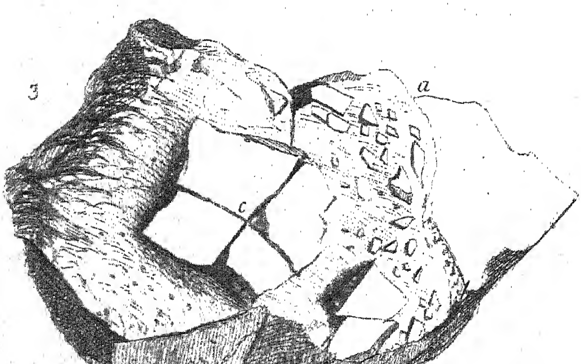

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

"................ per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 123. JANUARY 1847.

I.—*On the Formation of the Flints of the Upper Chalk.* By J. Toulmin Smith, Esq.

[With a Plate.]

VARIOUS theories have, at various times, been proposed to explain the very curious and interesting phænomena connected with the presence of flints in the upper chalk. Having for some time paid close attention to the facts, from which alone any true theory can be framed, I would now offer a few observations on some of the more prominent of those theories.

The theories which have been proposed have had very different objects, which it is desirable to distinguish clearly at the outset. Thus, while Ehrenberg and Dr. Turner have suggested explanations of the *origin* of flint itself, without entering into detailed observations on the particular modes and forms in which we now find it in the chalk, Dr. Buckland and Mr. Bowerbank have endeavoured to explain, not the *origin* of flint, but the forms and modes in which it is now found.

Disposed as I am to regard the explanation offered by Dr. Turner*, combined with other sources known to exist, of the *origin* of the siliceous fluid as sufficient and satisfactory, the suggestions of Ehrenberg being, at any rate, applicable in particular

* See "Lecture on the Chemistry of Geology," Philosophical Magazine, vol. iii. (1833).

cases and to a very limited extent only, our attention will at present be principally confined to the theories which attempt to explain the forms and modes in which the flint is now found.

Of these, the theory of Dr. Buckland, that flint and chalk being deposited together in the form of viscid fluids the former separated itself from the latter according to the well-known laws of chemical affinity, is of too indefinite and general a character to be readily applied and tested in individual cases, though, as we shall find, such opportunity does sometimes occur. The theory of Mr. Bowerbank alone proposes a distinct and definite explanation of all the forms and modes in which flint, either in nodules or tabular masses, is actually found. To that theory therefore I will direct chief attention, the more so as it has very recently been advocated in this Journal*, and as I believe the views expressed in Mr. Bowerbank's published paper on the subject† are still held by their author, and they come from him with an authority so great as to claim the most careful and candid examination.

Mr. Bowerbank's views may be shortly stated to be, in his own words, "that the common tuberous flints, the horizontal tabular flints, and those forming perpendicular or oblique veins, were ALL produced by the same agency," namely, IN ALL CASES from sponges, of which those flints occupy the exact places, though of the sponges themselves but small remains generally exist (see pp. 183 and 186 of the paper referred to).

It is not my intention to dispute the particular facts stated by Mr. Bowerbank as applying to the cases observed by him. What I undertake to show is that those, admitting their correctness, are not *all* the facts, and that many others exist wholly inconsistent with the conclusions which Mr. Bowerbank would draw. And it is here well deserving of remark, that, while Mr. Bowerbank finds in such abundance on the exterior of all flints sponge spiculæ and evidence of the mouths of the excurrent canals of sponges, Ehrenberg finds the same exteriors to consist almost entirely of the skeletons of Infusoria! No one accustomed to the use of the microscope can be otherwise than aware how much very minute objects seen under a high power are apt to assume a character in accordance with preconceived notions; and when we find such careful observers as Mr. Bowerbank and Ehrenberg thus differing altogether and in so very marked a manner in the results of their examinations, it may be allowed us, in all humility, to call in the aid of other classes of facts to clear up the mystery, and this I now proceed to do.

I fully admit that spiculæ are not uncommonly found in some

* By Prof. Ansted, 1844.

† Geol. Trans. vol. vi. 181.

flints, but they are most assuredly not always found; in some flints they are very numerous, while in others from the same spot they are exceedingly rare, and in very many wholly wanting. Now these sponge spiculæ are indestructible. The destruction of the structure of the sponge, which this theory requires as a necessary postulate, would not destroy them. How then is it that they are thus variably present? And it is important to remember that similar spiculæ are also found in the chalk itself.

It may be remarked, in passing, that this theory, if true, presents us with a phænomenon still more extraordinary and unaccountable than that which it is called in to explain. It is taken for granted that the flint itself is a foreign substance which has filled the places formerly occupied by sponges. Now how happens it that flint should be found in such places only? and this restriction, be it observed, besides being expressly made by Mr. Bowerbank, is necessary to the existence, in any shape, of the theory. If it is once admitted that flint is ever, or may be even in a single instance, found elsewhere, the theory ceases to be an explanation of the phænomena, and becomes of no value to the philosophical inquirer. Now, can it be shown that silex has any peculiar affinity for either the animal substance or the horny skeleton of sponges? The contrary is known, as matter of fact, to be the case. Facts palæontological as well as recent might be cited in abundance in disproof of this necessary postulate of the sponge theory. I have undoubted sponges in my possession from the chalk, which, instead of being wholly silicified, are in *part* so, and in *part* still in the chalk, while the flint is otherwise extended beyond the boundary of the sponge. Such facts disprove the alleged special affinity. But if we turn to events going on before our eyes, we find that not only is silex abundantly secreted on the leaves and stalks of the *Plumbago*, and at the joints of the bamboo, and in many other instances, but the plants growing near the Geysers in Iceland, as well as near the hot springs in some of the Azores, are incrusted with silex, in which many are completely imbedded, and that without the presence or neighbourhood of any sponge whatever. These facts alone, apart from those of a like nature which will presently be named, and which every one must feel to be clearly analogous, are fatal to the theory. They show analogous results produced at the present day by a wholly different set of causes from those suggested by the sponge theory and necessary to its maintenance.

It is admitted that it is very rarely, if ever, that the reticulated tissue which is conceived to have belonged to sponges is found throughout any considerable portion of the flint; that often but little of such tissue is found; often no trace of it at all. Now these facts want, but have not had, explanation. How is it that

the bodies themselves whence the flints are said to derive their forms are almost wholly, often wholly, gone, and yet in those very flints are preserved structures, as we shall see, in endless variety, every whit as delicate and beautiful as the sponges themselves, and that too of bodies which, according to the very assumption of the theory, were themselves dead before the sponge was formed over them?

But it may further be asked, how happens it that there are found in flints *fragments* perfect and in beautiful preservation of the reticulated tissue, while all the rest is wanting? This is inconsistently enough an admitted fact,—a fact itself proving that the destruction of this tissue, assumed to have taken place in all but these fragmentary places, is not a necessary or easily explainable fact. These fragments generally show under the microscope a clear and distinct *torn edge,* not a going-off into gradual indistinctness as would be the case if they were the remnants of a large body formerly filling the place of the flint. I can readily understand that fragments of sponges might float about in the ocean mud and become, with other organic remains, imbedded and preserved in flint. We find precisely such fragments in the chalk also. Such a view fully accounts for the presence of these fragments in the flints, while their presence in that fragmentary state is totally inconsistent with the idea of the whole mass of flint having ever been made up of such tissue.

Moreover, perfect sponges do exist among the flints. These however assume a totally different aspect and form to ordinary flints. I have several specimens, in which the general form of the sponge, with its roots, is perfectly preserved, and the structure very beautifully displayed on fracture; and, placed side by side with a fine specimen of recent sponge, the one seems but the solidified representation of the other. Not so the flint nodules or tabular masses. They assume every variety of fantastic form, while it is admitted that roots, or traces of them, are not to be found.

We advance now to another and distinct branch of the inquiry; namely, as to the evidence afforded by the organic remains, undoubtedly other than sponges, which are found in flints: and I think we may derive equally conclusive evidence from this class of facts.

Where, in recent sponges, do we find the innumerable quantities of shells and other large objects that we find in the chalk flints? In a specimen now before me, by no means a picked one, I find projecting from the exterior two Plagiostomas, a Terebratula, a Pecten, twelve Ostreas and several Serpulas; all these obvious; besides innumerable smaller shells and several portions of a quadrangular Ventriculite. This specimen is about 8 inches

by 4, unbroken, and of most fantastic form. Another, about 4 inches by 3, and containing one Ventriculite which it just encases, presents two beautiful Dianchoras and at least eight Ostreas, besides many small shells. These are lying on the external surface, just sunk, as it were, in the flint, as they would sink in water, but not at all covered*. No hollow of a sponge could have retained them thus.

I have seen, in Mr. Bowerbank's valuable collection of sponges, a specimen in which one small shell is imbedded: this may have happened in casual instances with small dead shells, but where can it be found, in recent sponges, from the most favourable spots, that they are full, as we find the flints full, of bivalves large, numerous and perfect, and apparently living when enveloped?

It is assumed by this theory that the sponges grew over the shells and other organic objects which lay on the surface of the mud. But the observed facts are wholly at variance with this assumption. The organic bodies are found, not on the under surface of the flints only, but equally on all parts of the surface and in all parts of the inside. Now how can this be accounted for? Shall we suppose that the shells, &c. sank down from above and rested on the sponges till grown over, unaffected by their natural tendency to fall to the actual bottom on the slightest motion in the water? What follows then? necessarily this: that the upper surfaces of the *tabular* masses would, far more than any other flints, display these remains, as such shells, &c. would be far less liable to roll off the assumed sponges of this form. But do the facts support this necessary conclusion from the sponge theory? Assuredly not. It is the nodular flints in which are found most of the organic remains of the class alluded to. Thus on the flat surfaces, off which shells, &c. could not fall, they are not found in any abundance, while on the smaller and nodular masses, of all sizes, off which the least motion, if not their natural gravity, would cause them to fall, they are found in great abundance! The same result follows from the observation of the fact, that on the *under* side of the upper part of the goblet-shaped flints which inclose Ventriculites (and the upper and under surfaces of which can therefore be positively known), shells and other remains, not originally affixed to the surface of the animal, are found, which therefore could never have been either lying on the ground or have fallen from above. These two sets of facts are equally conclusive against the sponge enveloping theory.

The Echinites alone, extensively examined, afford conclusive evidence against the sponge theory. These are very frequently indeed found in the very centre of flints. They are sometimes

* See note, p. 7, for explanation of this fact.

found with spines affixed, and therefore alive or with undecomposed soft parts when entombed. The masses of flint to which they are affixed are very frequently not attached to either of the large orifices of the shell, but to some part of the sides, while the shell is entirely filled with flint and both orifices closed. Mr. Bowerbank states that, when the shell is not entirely filled with flint, in "the space thus unoccupied by the flint was *always* included one or both of the large orifices of the shell*." I do not find this fact in any degree borne out by my own observations. I have specimens at this moment before me in which the reverse is the fact,—both orifices being closed though the Echinite has never been filled with flint. Many other illustrations of the clear inapplicability of the sponge theory to the case of Echinites might be given.

It is frequently the case that the remains of a zoophyte are found in the exact centre of a flint which is externally round. In some localities these abound, and they occur from the condition of a very friable substance, perfectly preserving the structure however, and merely coated with a layer of flint, to the same body perfectly solid and silicified throughout, though still clearly showing the structure. It is easy to understand that, in particular classes of objects (such *e. g.* as some of the beautiful objects inclosed in the Wiltshire flints) and under particular circumstances, the affinity for the siliceous fluid might not be sufficiently great, or the rapidity of its solidifying too great, to allow of its penetrating the body round which it formed. In such cases we should necessarily find, as we do, that the soft animal substance, not being penetrated, has decayed†, leaving only what we find,—the hard and, so protected, indestructible parts; where it was wholly soft animal matter a mere hollow is found. The extent to which penetration extended will of course affect the facts exhibited. The explanation offered by Mr. Bowerbank of the Wiltshire flints is clearly inadmissible. Had they been dead and sponges grown over them, it is obvious that they would not, as now, have been *loose* within the flints, but solidly encased, as shells and corals are found.

I have an Asterias in the centre of a flint. Teeth, pieces of wood, &c. are often found in flints, which could never have become entangled within the meshes of a sponge. It will be said that the sponge may have been built over them. This, though highly improbable, may be possible; but there are cases to which such an explanation cannot apply, in which flint is found in situ-

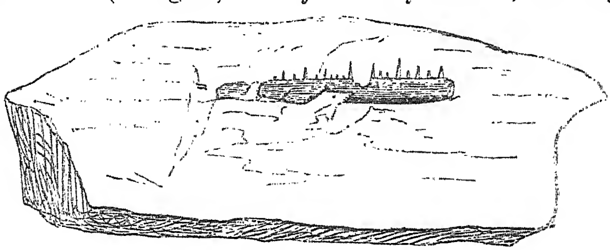
* *Loc. cit.* p. 186.

† I believe it may be stated as an invariable rule, that there is an orifice, large or minute, in all such cases, through which the gases evolved might escape.

ations to which it is impossible that, on the sponge theory, it could have gained access.

The specimen of Mososaurus (*Leiodon* of Owen *), discovered by Mr. Charlesworth, exhibits the pulp cavities of the teeth partially filled with flint. This is sufficiently remarkable; but those teeth being large, and the cavities not being wholly *filled* with the flint, it may not perhaps, alone, be considered as absolutely conclusive. What is wanting in this case is however fully supplied by the following:—

I have a flint, in the centre of which is found, by a happy fracture, a jaw on which are made visible, by the fracture, at least sixteen teeth (see figure). They are very minute; the largest



Jaw of *Enchodus* (?) in flint.

not exceeding in size the point of a pin the eighth of an inch in length. On examining this very interesting specimen under the microscope, it is found that, though the jaw itself is perfect and not silicified †, the pulp cavity of each tooth in which the fracture has exposed it is entirely *filled* with solid flint. How did that flint get there? Geological phænomena will indeed be easily explainable if we are to believe that any sponge gemmule ever found its way into these minute and perfectly inaccessible spaces, and still more that, having found its way there, it was able to exist and grow there without any possible access to the very essential means of its existence, the sea-water. That the silex when in solution possessed however the power, and that it was one of its qualities, to penetrate some of the most intimate tissues of organic bodies within its range, will appear from the next class of facts cited; in reference to which, as well as to the last-named facts, it may be stated that soft animal matter appears to have had a greater

* Odontography, p. 261. and pl. 72; and a section is figured in the London Geological Journal for Sept. 1846.

† See this phænomenon alluded to in a very interesting paper by Dr. Mantell in the 'Annals and Magazine of Natural History,' vol. xvi. p. 80. The whole article is well-worthy of attentive perusal. The same principle will consistently explain why, as often seen, though a Ventriculite was enveloped in flint, the shells on it were left bare, not having so much affinity for the siliceous fluid as the soft animal substance of the Ventriculite. On the sponge theory this frequent fact would be utterly inexplicable.

affinity for the silex than bone or shell; through which latter the silex would frequently pass without lodging there in order to reach those parts for which its affinity was greater*.

We now come to the innumerable cases in which organic remains belonging to the many varieties commonly, though very loosely, grouped as Ventriculites, whether cyathiform, flexuous or quadrangular, and Choanites and the like are found imbedded in flints; and many of the most delicate of which we now find imbedded in the solid flint with yet a light floating elegance of form as if still enjoying life in their native liquid element; and which facts assure us that they were thus suddenly and instantaneously fixed in a moment of the highest vitality.

What are the conclusions to which a careful and extensive examination of these objects necessarily leads?

First, that the animals were enveloped *while living*†, *and not after death*, as the sponge theory assumes as a necessary postulate. The specimens are found both in flint and chalk in precisely the same conditions. They are found in all states, from the fully expanded to the closely contracted. They are found—not, as is the case with the sponge tissues, rarely or never, but—very generally in a perfect state of preservation, the whole tissues and structure being preserved to us in a condition fully as clear as if the living being were before us. Now it is very easy to conceive of the living animal being suddenly enveloped in a mass of soft mud or other liquid which hardened more or less rapidly, but we cannot conceive of its allowing the growth over it, while living, of a sponge which enveloped without killing it or altering its appearance; still less of that sponge afterwards decaying and leaving the inclosed body undecayed.

Second. It is beyond a question that the cause which gave rise to these flints was not a foreign body *enveloping the exterior* of the Ventriculites and other bodies, but a substance which possessed the quality of penetrating their most intimate structure. It is only necessary to examine polished specimens of either Choanites or the cyathiform, quadrangular or flexuous Ventriculites, or the specimens of either cracked open, when, as is often the case, they admit of this, to be fully satisfied on this point. The structure of these bodies themselves remains perfect and most beautiful, while no enveloping structure or tissue can be made out, except in the occasional fragments already noticed. Again, it is not unfrequently found that the flint itself has *only*

* The same point is well illustrated by cases of fish and crustacea, of both of which I have specimens of which the integument remains unsilicified, the interior is solid flint.

† This might easily be shown to have been the case with other classes of objects, but space forbids extending the illustrations. All these soft parts are preserved, and yet the enveloping sponge has decayed!

penetrated the internal structure, none being found encasing either the external or internal surface*. This would clearly be inexplicable on the sponge theory, but presents itself as a frequent phænomenon in several of the classes of objects above enumerated, and is consistent with the observed fact, already noticed, of the affinity of the silex for soft animal matter. When, moreover, flint is found enveloping the outside of a Ventriculite, it is almost invariably found enveloping it, to exactly the same extent and no more, on the inside, and this without the edges of the Ventriculite being at any point overlapped. It is obvious that no sponge can have possibly grown in this manner. Again, the delicate roots of these bodies are very frequently indeed, *more frequently than any other part,* found preserved in flint, a fact in most diametrical opposition to the very fundamental and necessary postulates of the sponge theory, as the sponge would clearly lie upon, not penetrate into, the mud. Yet these ventriculite roots are thus commonly found, while it is admitted that no place of root is to be found belonging to the so-called sponge masses themselves. I have a specimen in which, in one block of chalk, there are *five* Ventriculites. The stem and root of *each one,* and no other part, is enveloped in flint.

It may here be noticed as an interesting and important fact, that it will be found, on careful examination, that not only is the internal structure of the Ventriculite preserved, but, in fine specimens opened with care, the integument of the animal, which presents quite a different structure, is also preserved, covering over the internal structure; and thus at the same time disproving the alleged sponge character of the Ventriculites†, and showing that, at the time when the silex aggregated round and penetrated the Ventriculite, this integument was unbroken. So in Choanites, which have quite a different exterior, that exterior will be frequently seen perfect, clear and distinct, while exterior to it is a layer of flint.

It will be obvious, that if the sponge theory is to be taken as any explanation at all, it must assume, in addition to the inadmissible postulates already noticed, the inconceivable phænomenon that every one of these living bodies was penetrated by the sponge, since the very object of the theory is to show that all the spaces now occupied by flint were once sponge, that is, that silex has precisely replaced sponge and *nothing else*. If it does not go this length it is of no value whatever as a theory, since

* It is worthy of particular remark, too, that all these bodies are very frequently found only partially enveloped in flint, the remainder of the body being found in the adjoining chalk. This affords clear demonstration against the sponge theory, but space will not allow of my entering on this very interesting class of facts.

† See Prof. Ansted's paper above cited.

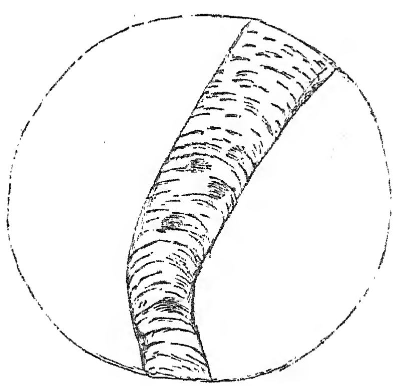
there is no doubt, as already seen, of sponges being, like other remains, sometimes inclosed in flint: the point is to explain upon a general and *universally applicable* principle, the presence, in all its forms, of flint; and this has been seen by the extract already given to be the express intention of Mr. Bowerbank. If therefore it appears that it is impossible, in any one particular instance, to explain the presence of flint on this theory, the theory itself falls wholly to the ground as an explanation of the phænomena. Its insufficiency is not any more demonstrated, though it is further illustrated, by multiplying such instances or sets of instances. Such illustration is afforded by the variety of facts which have been already cited, and the citation of which, did space permit, might be extended almost without limitation. It is conceived however that it has been sufficiently shown, *first*, from the condition of the assumed sponge remains themselves, *second*, from the nature and condition of the inclosed organic bodies, that the sponge theory is in nowise tenable as a comprehensive theory to explain the origin of the forms and modes in which flint is now found in the chalk.

We will now take another ground apart from any internal examination, to which we have hitherto confined ourselves, of the substance of the flint. And we shall find, on taking a careful review of some facts of the *external* forms and modes in which the flints are found, that the sponge theory is not only wholly unsatisfactory, but absolutely impossible; while we may gain some hints as to the true origin of these masses. To avoid extending these remarks to too great a length I shall confine myself to a few cases, which however are conclusive, and all of which, with many others confirming them, have been collected by myself upon the spot; and I purposely select such as have been collected at spots many miles apart.

The reader is requested to examine carefully the specimen represented in fig. 1 of Plate I., which is, with the others there figured, of the natural size. It will be seen that the external surface of this specimen is entirely covered with strong liny ridges. These ridges overlap one another precisely like pieces of card-board cut to a clear square edge, or, to take another and I believe an exact analogy, as flakes of ice just on the point of congelation would do if violently agitated*. They rise one above another about, on an average, the twentieth of an inch, and, as it will be seen that they run in various directions, they thus give to the surface a very peculiar form, the anticlinal axis *b c* crossing it, and there being at *a*, where the ridges run concentrically, a deep and very accurately rounded cup, of which a small space at

* In an experiment with Glauber salts, made since the above was written, I found, on an accidental motion given, exactly the same character of ridges assumed.

the bottom is flat and all around the ridges rise regularly and concentrically; giving necessarily the idea of some liquid substance, of which the surface was very rapidly solidifying, and disposed altogether to very rapid solidification, and which at the exact moment of such condition was affected by some small rapidly revolving eddy, while the other parts of the solidifying substance were at the same moment affected by small but rapid currents running in opposite directions. This very motion probably caused the solidification of the mass, for, curiously enough, there are fewer marks of organic remains in this and another similar flint than in any others I possess*. The edges of all the ridges are sharp, although in this instance, contrary to what we shall presently find in another, the whole surface, under the angles of the ridges as well as above them, is covered with the mealy coating. The under surface of this flint is covered with ridges precisely in the same manner as the surface figured, and in a manner which renders the specimen still more striking as illustrating the action of the supposed currents. Traces of the flakes which have thus been forcibly slipped over each other are also observable in the substance of the flint, at a cross fracture, precisely as might be the case where flakes of ice, slipped over one another, varied slightly in colour, from some contained substance, while separately exposed and before being piled over by a mass of other liquid, on whose thus forcibly and rapidly upraised surface the broken edges of other flakes would of course be seen; and the whole of which mass, so piled up and very rapidly solidified by the very agitation thus given, affords the most exact idea of the present specimen. I have another specimen presenting exactly the same general characters of liny ridges with sharp overlapping edges, though the form assumed is different. I have also a most interesting section of flint, presenting, under the microscope, evidence of a precisely analogous train of facts and consequences. This specimen, which is here figured, speaks for



Traces of revolving particles in flint magnified about four linear.

* "The slightest disturbing causes, as *agitation*, change of temperature *or* the affinity, though slight, of some other body for the solvent, would put an end to the solution."—*Turner's Lecture*, as before cited, p. 26.

itself. The lines on it present no trace of organic structure, but are obviously caused by the rapid revolution of the particles, to which motion the flint, almost free from trace of organism, probably owed its solidification.

These facts are obviously totally incompatible with the sponge theory. Not only is it clear that no sponge can ever have taken such forms of growth as these, which are obviously the result of mechanical causes acting, not on an animal substance but on an inorganic one; but, while the sponge theory, necessarily assuming as it does the decomposition of the saturated sponge, requires as a necessary postulate a very slowly solidifying body, as the only means of accounting for that decomposition, the facts above named obviously point to a very rapidly solidifying substance, a condition, too, best agreeing with known phænomena. Nor do the facts admit of that substance being of the nature suggested by Dr. Buckland. They seem, on the contrary, necessarily to indicate a substance which, while of a considerable specific gravity (flint is 2·59), was in an extreme state of liquidity* for the time, but liable to extremely rapid solidification; in fact such a substance as Dr. Turner indicates. The sharp edges, as well as the character of the ridges, preclude the supposition of a viscid fluid. Phænomena analogous to those suggested as explanatory of the condition of fig. 1 are often seen in cold weather in a vessel of water in which fine flakes of ice only are seen while it is at rest, but the moment it is agitated the whole becomes a solid mass. Similar phænomena may be produced experimentally in many ways.

The rare occurrence in the flint of instances like those just stated probably arises from that very rapidity of solidification which explains those particular instances; a solidification which contact with any organic body would equally induce, and which would of course, therefore, prevent frequent liability while yet liquid to such casualties as there happened. That rapidity of solidification,—a fact, as has been seen, inadmissible on the sponge theory,—is demonstrated not only by the facts last stated but by those to be next named, and which, with the last, render it indisputable that the flint was perfectly solid and brittle (and not in anywise in the state of a glutinous or viscous mass) before the chalk itself became solid or was in otherwise than the state of a soft mud, but yet while it was in a state of mud and not

* Dr. Turner speaks, p. 27, of the silica being in a gelatinous form and hardening slowly. Why this should ever have been assumed does not appear, and both parts of the assumption are obviously directly inconsistent with all the general principles enunciated in that lecture and with observed facts, as above shown. There is probably some incompleteness in this part of the report of his lecture.

merely of muddy water *. This is a very important point, as it enables us to explain very many of the most striking phænomena connected with the deposit and contents and aspect of flints.

Pl. I. fig. 2 represents a specimen extracted with elaborate care from the rock with my own hand, and in which therefore no mistake exists as to facts or appearances. It is a mass of chalk in which is a flint in part enveloping a Ventriculite, though a part of it (on each side of *d*) is an instance of a frequent case above named, where the flint is found *not* enveloping but only penetrating the substance of the animal; and the specimen affords the yet further illustration of a Ventriculite preserved partly in flint, partly in chalk. Now this flint formerly enveloped with an extremely thin coating (not the eighth of an inch thick) the lower part of the Ventriculite, together with the stem and roots. *After* it was thus encased however, and while the chalk was yet a soft mud, the flint, then necessarily solidified and brittle, was by some accident broken. The force which broke it nearly expended itself in so doing, and was not sufficient to overcome entirely the adhesive properties of the mud and so to remove the separated parts to a great distance. In this instance there were in the chalk, when I found it *in situ*, four pieces of flint *a*, *b*, *e*, and one at *c*, the impression of which last remains, but the piece itself was broken out before I discovered the nature of the specimen: *a*, *b* and *e* remain exactly as they were. Neither of them has ever been disturbed, and each is perfectly fixed and firm in the chalk. The chalk still remains, filling up the spaces between them and between *c* and *a*, except where I have, to a slight depth, cleared it away between *a* and *b* in order to ascertain the interesting fact to be next stated, namely, that the substance of the structure of the Ventriculite is perfectly preserved and displayed in each piece *a* and *b*, and *the edge* a *is the exact counterpart of the edge* b, *and would fit to it if they were brought in contact.* A more interesting fact it has seldom been my lot to develope in the course of my geological researches. This case alone is sufficient to establish beyond possibility of dispute the proposition to illustrate which it has been cited. Neither the mass of chalk in which it now exists, nor that from which it was extracted, does or did exhibit, on or near the place of this fracture, the slightest trace of any movement or displacement. Being, as above said, obviously in a state of soft mud when the accident happened, it was sufficiently adhesive to retain

* This condition, while thus demonstrated, explains with a beautiful consistency the very frequent fact of Ventriculites, &c. preserved half in flint and half in chalk. I regret that space will not allow me to enter on that point, which an extensive reference to facts only may render obvious to those unfamiliar with the phænomena.

the pieces in these positions and to prevent injury to the exposed parts of the Ventriculite, but filled up the space made by the fracture, and afterwards gradually hardened, bearing itself no trace of the event.

I have also another and larger specimen in which precisely the same state of facts is found, and which therefore, though an important illustration of the results learnt from the last specimen, it is unnecessary to describe in detail.

Fig. 3 of the Plate exhibits phænomena of the same character, but carried further. A mere glance at the figure will show that the mass of flint is covered by sharp angular pieces of broken flint adhering to its surface. These do not, as in the case of fig. 1, rise as mere ridges. They are clearly broken fragments of a flint already solidified, which have here lodged on this mass while in the act of solidifying, and have become a part of it. The places of union show no mark of junction or fracture: they are completely united. The edges are sharp enough to cut the finger, and the mass *c*, the largest, and which is itself, as will be seen, cross-cracked into four pieces which are now at slightly different elevations, rises at least the sixth of an inch above the mass onto which it is fixed. The edges of these pieces are *not* covered with the mealy coating*. It should be remarked that the minute angular fragments scattered all over the surface of this specimen are much more numerous than could be represented with clearness in the figure, and that the whole mass on which these angular fragments rest (the left-hand portion of the figure) has received a slip over to the right, so as to leave a ridge at *a b* of a quarter of an inch high and having a very sharp edge, and beyond which to the right *not a single angular fragment is found.*

It is clear that in this case a very different state of things took place to what happened in fig. 1, although equally clear, as in that case, that the sponge theory is directly opposed by the facts, as neither could any sponge thus fracture (which, if that theory be true, must be assumed), nor could such broken fragments fall in this manner onto a soft sponge and become thus part of its substance. It is obvious that a mass of flint had become perfectly solidified; that that solid mass became by some accident greatly shattered; and that some of the fragments fell through

* Thus disproving a view which has been advanced, that the mealy coating is the mere effect of exposure to carbonate of lime and the deprivation of some of the water of the flint thereby. These parts have been in every respect equally exposed with all other parts, but were not so until after they had become solid. The mealy coating does not seem to present any difficulty, but space will not allow me now to enter into it further than to add that I have found it covering a large part of the surface of flints inclosed in Echinites.

the soft chalk-mud upon another mass at that moment on the point of solidifying. The movement which caused this fracture and impelled the pieces onto the yet fluid mass was probably the same which caused the whole surface on which the fractured pieces alighted to slip forwards, and which surface and the mass beneath it, probably by the very agitation thus caused, instantly solidified, leaving the ridge *a b*, and fixing the fractured pieces firm.

This case illustrates and demonstrates all the conditions already noticed; extreme liquidity and rapid solidification of the flint, together with the soft state of the surrounding chalk.

It is unnecessary to enter now into further details of facts, or to dwell long on the conclusions to which the numerous facts above cited lead us. Some of these conclusions have been suggested in the course of these observations, others will naturally suggest themselves *. Numberless facts unite to show that the sponge theory is wholly untenable, while they point to a state of facts easily conceivable and analogous to what is found in other formations; which is in accordance with known laws and experimental phænomena; and with which all the observed phænomena of flint will be found consistent. For different mineral concretions to form themselves round organic centres, by the combined effect of some affinity thereto and of their own molecular attraction, is a phænomenon of frequent occurrence. In the Septaria of the London clay, each having its organic centre, numerous organic remains are found interspersed, and frequently half imbedded and half projecting on the surface, precisely as is the case with the flints. The siliceous solution, which was probably supplied periodically only, being supplied but to a limited ex-

* I conceive it unnecessary to enter here at length on the question of the arrangement of the flints in layers. Such a phænomenon presents no greater difficulty than any fossiliferous layers proving several distinct and successive bottoms of the sea; such, for example, as form so marked a feature of the Dudley limestone. There would thus always be some bottom sufficiently hard to resist the pressure caused by the specific gravity of the siliceous fluid and flints, the greater part of which would thus fall onto it through the softer mud above. Scattered small flints are found between the layers, which a variety of causes may have arrested in their descent. The distances between the layers are by no means equal; the modifying conditions which caused at intervals, in this formation like others, a relatively hard bottom to form, varying at different times. That such "modifying conditions" must be taken into consideration will be evident from the important facts that in the Lower Chalk no flints at all occur in the south-east of England, while in the Middle Chalk they do occur scattered indiscriminately through the mass; but it is only in the Upper Chalk that they assume the peculiar stratified arrangement which marks it. To explain these facts on the sponge theory would indeed be impossible, but they are perfectly consistent with the conclusions above drawn, and those conclusions and these facts mutually illustrate each other.

tent and during a certain part of the chalk formation only, differing, as is known, in different localities, could only form itself into masses which occupy a certain space. Whether it took the form of nodular or tabular masses was owing to local modifying causes. Where organic remains of any considerable size, or grouped in particular masses, happened to be abundant and lie near one another, they acted as separate centres, while the solution was attracted to them in a mass. Hence the fantastic and varied forms in which we find the nodules, together with the projecting bodies, the supply of material being often too limited to encase the whole of all the organic bodies by which it was attracted. Where those bodies were less abundant or less individualized,—as where there was a layer of minute organic bodies,—there would be fewer centres of attraction, and tabular flints would be formed. Wherever the concretions happened to form themselves they would be attracted by and envelope, more or less, every organic body with which they came in contact, living or dead. That the siliceous liquid possessed the power of penetrating,—that is, had some peculiar affinity for,—the substance of the organic bodies, vegetable or animal, which it enveloped, and even sometimes without being in sufficient quantity to envelope them at all, is a fact which we see before us. This may be a fact difficult to explain, but it is one which is exemplified in innumerable other instances, and which is not therefore peculiar to flint *.

Such are the conclusions to which a very careful and extensive observation of the phænomena of flints has led me. Accepting the views of Dr. Turner, combined with the well-known facts of the products of thermal springs, as affording a satisfactory and the most probable explanation of the *origin* of the siliceous liquid, I offer these conclusions as explanatory of the modes and forms in which we actually find the flints themselves: and I offer them without being wedded to any preconceived notion or theory, but simply as the results of extensive observation, and as alone appearing consistent with all the varied class of facts which that observation has brought under my notice.

Highgate, Nov. 1846.

* The extreme liquidity of the siliceous fluid, combined with its specific gravity and the superincumbent pressure, help to explain these facts. The questions of that specific gravity of the siliceous fluid, and of its not undergoing any material contraction when solidified, cannot be here discussed, though illustrating and supporting the conclusions to which other facts have above led.

II.—*A Supplement to "A Synopsis of the British Rubi."* No. I. By Charles C. Babington, M.A., F.L.S., F.G.S. &c.†

The publication of my Synopsis of the British *Rubi* has already resulted in the discovery of several additional British forms of this difficult but beautiful genus. These I purpose publishing at intervals as time will allow me to determine them with accuracy.

25. *R. glandulosus*, Bell.

δ. *dentatus*; caule subanguloso piloso setoso, aculeis parvis paucis, *foliolo* terminali ovato cuspidato basi cordato inæqualiter apiculato-*dentato*, paniculæ hirtæ aculeis paucis tenuibus rectis declinatis setis brevibus multis apice et ramis paucis brevibus distantibus divaricatis paucifloris corymbosis.

Whole plant of an ashy green colour. Barren stem rather angular with small not very numerous yellow prickles; hairs and setæ abundant, nearly equal, short. Leaves very like those of *R. Bellardi* but different in colour, thinner, much less hairy (with scattered hairs on both sides), the terminal leaflet cordate at the base‡; petioles armed like the stem, except that the prickles are deflexed (this is also the case in the *R. Bellardi* from Terrington Car—in the 'Rubi Germ.' they are represented straight). On the flowering shoot the hairs are more numerous relatively to the setæ than on the barren stem; both are very short; prickles few, scattered, short, very slender. Leaves all ternate, the uppermost 1—3 excepted, which are usually simple. Branches few-flowered, subcorymbose; panicle corymbose at the end; sepals lanceolate with an attenuated point, setose, acicular, reflexed from the fruit.

Abundant near Twycross, Leicestershire, *Rev. A. Bloxam*, from whom my specimens were received.

Obs. Very closely resembling the typical *R. glandulosus* (*R. Bellardi*), but differing remarkably in its colour, the dentition of its thin leaves and its fewer prickles and aciculi, and more numerous hairs on the barren stem. N.B. A specimen of this bramble will be found in Bloxam's 'Fasciculus of Rubi.'

25*. *R. Günteri* (Weihe); caule subanguloso sparsim piloso et setoso, *aculeis* inæqualibus nonnullis *validis sed brevibus* rectis declinatis multis, *foliis ternatis* vel quinatis inæqualiter *dentato-serratis* concoloribus supra glabris subtus ad venas pilosis pallide viridibus, foliolo terminali late obovato cuspidato, *paniculæ thyrsoideæ* hirtæ

† Read before the Botanical Society of Edinburgh, Dec. 10th, 1846.

‡ The leaves are almost invariably ternate, but rarely a quinate leaf occurs.

inferne foliosæ aculeis paucis tenuibus rectis declinatis setis brevibus *apice et ramis* brevibus ascendentibus *multifloris paniculatis.*
R. Günteri, *Weihe, Rubi Germ.* 63. t. 21.

Prickles rather numerous on the barren stem, remarkably declining, but straight, short, their base thick ;. hairs few ; aciculi more numerous ; setæ rather plentiful, short and nearly equal (in an old shoot now before me the hairs, aciculi and setæ have nearly all fallen off). Leaves ternate or (in very rare instances from the subdivision of the unequal lateral leaflets) quinate, green on both sides, nearly or quite glabrous above, rather paler, and with yellowish downy and hairy veins beneath ; terminal leaflet broadly obovate, cuspidate, slightly cordate or emarginate below ; lateral leaflets placed nearly at right angles with the intermediate leaflet as in *R. glandulosus* and *Bellardi,* unequally ovate or lobed on the lower margin, cuspidate ; all irregularly but rather strongly dentate-serrate ; general and partial petioles and midribs beneath armed similarly but less strongly than the stem, and their prickles are often deflexed ; stipules linear, hairy, setose. Flowering shoot long, very hairy, with rather numerous, short (and a few longer) slender declining prickles ; aciculi and setæ short, not longer than the hairs, not very numerous, except in the upper part of the shoot and amongst the flowers. Leaves ternate ; leaflets nearly equal, rather obovate or lanceolate, green and hairy on both sides with paler veins beneath ; general and partial petioles armed like the shoot but with more numerous prickles ; the two or three uppermost leaves simple, ovate or cordate-ovate, often lobed on one or both sides. Panicle long, narrow, with three or four axillary short panicled branches, and a long slightly compound panicled ultra-axillary summit with very short branches, each bearing four or five long-stalked flowers. Sepals downy, setose, ashy, with a long point, reflexed from the fruit.

Hartshill Wood, Warwickshire, in abundance, *Rev. A. Bloxam,* to whom I am indebted for most beautiful specimens.

Obs. 1. This plant very much resembles *R. glandulosus,* of which I was once inclined to consider it as a variety ; but its panicle is so different from that of all the forms of that species as to claim specific distinction. Its leaves (on the barren stem) are often exactly like those of typical *R. glandulosus* (*R. Bellardi*) in look and form, but differ greatly in their dentition. In one of the specimens now before me the panicle is almost exactly like that represented in the 'Rubi Germ.' as characteristic of *R. thyrsiflorus,* except that its upper ultra-axillary portion is narrower from its shorter branches ; other specimens have the ultra-axillary part shortened and the axillary branches lengthened, thus approaching some forms of *R. glandulosus.*

Obs. 2. *R. Günteri* is referred by Arrhenius to *R. glandulosus*, to which it is doubtless very nearly allied. Its armature seems to differ and so does its panicle. Probably *R. thyrsiflorus* (Weihe) is only a form of this species; and that, together, they will take a place close adjoining to, but not absorbed in, *R. glandulosus*.

N.B. This plant is named, on my recommendation, *R. glandulosus* var. *subracemosus* in the 'Fasciculus of Rubi,' issued lately by the Rev. A. Bloxam.

III.—*On a peculiar Organ found in the Rays* (Raia, *Cuv.*). By M. le Dr. Ch. Robin.

There exists upon each side of the tail of the Rays an organ which is not mentioned in any of the works which I have hitherto been able to consult. This apparatus however deserves, on more than one account, to attract the attention of physiologists, and probably of physicists also.

The two organs united form nearly the third of the entire bulk of the tail of the Rays. The bulk of each, at its largest part, is in one of these fishes of an average size, nearly that of the index-finger. Their origin is towards the union of the first and second quarter of the caudal appendage of the Rays, and they terminate in a point at the extremity of the latter. Their anterior extremity is soft and more or less slender, according to different individuals: it swells gradually as far as the middle of the tail of these fishes; the volume remains the same as far as the origin of the posterior quarter, whence it diminishes finally to the end. This organ is at first almost cylindrical, though a little flattened on the sides (to about the extent of the anterior quarter); in the whole of that part it is enveloped by several thin and concentric muscular layers. These muscles soon terminate in as many aponeurotic layers; the organ then becomes subcutaneous, and at the same time its form changes, becoming round externally and flattened within. In a word, this organ, separated from the tissues to which it adheres, presents the form of an elongated fusiform body, swollen in the centre, more or less blunt at the extremity, and always flattened upon its internal surface.

In a Ray one metre* long, the tail was 49, and the organ 36 centimetres in length; 11 millimetres in the transversal direction, and 13 from above downwards.

The tissue of this organ has the semitransparency of gelatine, but more consistence, and its colour is a clear translucid gray. It is furnished with a general fibrous envelope, which adheres to the adjoining tissues by aponeurotic membranous layers ranged at regular distances.

* The metre is equivalent to 39·37 English inches.

I have already said that its anterior portion was completely surrounded by some concentric muscular layers, and then that it became subcutaneous in its three posterior quarters, for the greatest part of its surface. I add, by way of more detail, that its internal surface alone is not subcutaneous, and is separated from the vertebral column by the two long muscular and tendinous bundles intended to move the caudal vertebræ. Its upper margin is traversed by a large subcutaneous vein, a branch of the lateral vessel; its external surface is traversed by the lateral vessel itself, which is accompanied by the lateral nerve. This nerve is situated betweeen the organ and the skin, throughout the whole length of the subcutaneous portion.

After these details on the relations of this apparatus with the adjacent organs,—relations, moreover, common to all the species of Rays,—I proceed to make known the *texture* of the tissue peculiar to this organ and the distribution of its vessels and its nerves. For this purpose I shall adopt a comparative course, that is to say, at each step I shall refer to the relations of this organ with those which most resemble it in other fishes.

On examining attentively the apparatus in question, we observe that its substance does not constitute an uniform gelatinous mass, but that it is divided into a large number of polygonal flattened discs by the partitions of cellular tissue. These discs have consequently two surfaces larger than the rest, one turned forwards, the other backwards. With respect to the faces of the circumference, they are in number three, four or five, which gives the discs a triangular, tetragonal or pentagonal form; their smallest diameter measures the thickness of the disc, which is 1 millimetre in nearly all the species. The diameter of the large surfaces, which measures the height of the disc, is 2 mill., one more in the *Raia rubus* and *R. batis*, and 3 to 4 mill. in the *Raia clavata*.

From this difference it follows, in the greatest diameter of the discs according to the species, that in a transverse section of the organ, from eleven to fifteen discs are counted in a *R. clavata*, and twenty to twenty-five in the *R. rubus* and the *R. batis*. The volume of the discs increases with age and the size of the individuals, but their number does not appear to increase.

These gelatinous discs are piled up one upon another, in the direction of the length of the apparatus, by the adherence of their broad faces, with the interposition nevertheless of a thin cellular partition. These longitudinal rows of discs are arranged side by side, reunited by a cellular partition thicker than that which separates each disc from that which follows or precedes it. The kinds of longitudinal columns represented by the piled-up discs are not rectilinear and do not all follow the length of one

of the faces of the apparatus; but they are more or less contorted, and are interrupted at intervals. The interruptions proceed from the discs becoming at intervals irregular, more narrow, and the series of discs terminates ordinarily in a very small, triangular one. It follows from these anatomical arrangements, that on the surface of the organ we may perceive one of the small faces of each of the superficial discs, and study very regularly the elongated, quadrilateral or lozenge-shaped polygonal, sometimes hexagonal form which it assumes in consequence of the reciprocal pressure which it undergoes from the adjoining discs. We may moreover very easily perceive that when the discs of a series begin to lose their form and are interrupted, there exist at the side other irregular discs which commence a new series. It is to be remarked also that the discs are ranged more regularly on the internal surface of the apparatus in the *Raia rubus* and *R. batis* than in the *Raia clavata*; in the first two species we also observe on the internal surface of the organ, that one of the partitions which separates the series of discs on the internal surface, follows its whole length and is of greater thickness than the rest: it is formed by glistening aponeurotic fibres, and it forms a sort of longitudinal pile into which the vessels and the nerves penetrate.

With respect to the gelatinous substance of the discs, magnified 400 diameters, it is seen to be hollowed out by cavities, and the walls of the latter are hollowed by cavities gradually lessening in size. The substance too which circumscribes these areolæ (to which we shall recur hereafter) is hyaline, homogeneous and transparent; it is studded with extremely fine molecular granules. From one spot to another are very regular granular spheres of $0^{\text{mill}}\cdot 0050$, surrounded by a very pale circular mass of granules similar to the preceding. It is impossible to recognise veritable cellules with walls and nuclei, and it is easy to see that the preceding areolæ are not cellules; we shall soon speak of their uses. On the margins of the discs, the homogeneous gelatinous substance presents regularly undulated striæ which it would be impossible to take for fibres.

At the point at which we are arrived, it is impossible not to recognise a great analogy between the semitransparent gelatinous substance which essentially constitutes the discs of the peculiar organ of the Rays, and that of the prisms of the apparatus of the Torpedo, the rhomboidal meshes of the *Silurus electricus*, and those interrupted ones between the transversal and vertical fibrous laminæ of the *Gymnotus*.

Although there may be differences in form between the discs of the organ of the tail of the Rays and those which constitute the prisms of the electrical apparatus of the Torpedo, these differences are certainly less considerable than those of the portions

of gelatinous substance circumscribed by the partitions and areolæ of the apparatus in the *Silurus* and *Gymnotus,* which however produce similar effects to those of the Torpedo.

The mode of arrangement of these discs is as regular in the Ray as in the Torpedo, and approximate much nearer to the latter than to that of the same parts in the apparatus of the *Silurus* and *Gymnotus.*

The nerves of this apparatus originate in the portion of the spinal marrow which is prolonged into the caudal vertebræ. I have an object in view in remarking that this portion of the spinal marrow must be composed of sensitive and motive nervous fibres, for it corresponds to the portion called *cauda equina* in the higher animals.

The nervous roots which originate from this organ do not take their rise together at the same level, but there springs alternately an anterior and a posterior root. It is always from the anterior one (before its anastomosis with the posterior) that the greatest number of nerves which exist in the apparatus proceed; lastly, some issue from the ganglion and the lowest branch of the two which proceed from it. These nerves are of the number of four to seven for each nervous pair. They are, as is seen, very numerous, and their diameter is from $\frac{1}{5}$ to $\frac{1}{2}$ millimetre. These nerves are finally distributed in the thickness of the partitions which separate the lateral muscles from the tail, when they penetrate into the organ, after being more or less subdivided. In the *Raia rubus* and *R. batis* the greatest number penetrate into the longitudinal pile of the internal surface; in the *Raia clavata* they penetrate into some one of the partitions of that surface. In these three species several branches wind round the superior and inferior margins of the apparatus to penetrate into one of the partitions of its subcutaneous portion. In the first two species these superficial branches freely anastomose before penetrating.

It results from these facts that a considerable number of nerves extend into the partitions of each series of discs infinitely subdividing. From these subdivisions part the filaments which penetrate between the partition which separates each disc from that with which it is in contact. This filament expands opposite to the anterior face of each disc, but never does a single one penetrate into the substance of the disc. The nerves spread out on the internal surface of the partition between it and the disc. No single thread ever ramifies against the posterior face of the disc; we shall soon see that this surface receives only vessels.

The elementary fibres of the nervous filaments have a double character; that is, they are true elementary nervous tubes traversed by a semifluid substance which escapes in drops of variable forms from their extremities when torn across. [These observa-

tions however would require to be verified upon animals fresh captured.]

The elementary tubes which spread out against the prism are from $0^{m}\cdot01$ to 0·013, that is to say, half the diameter of the elementary tubes measured on the nerves at the point of their penetration into the apparatus. The elementary nervous tubes do not terminate in a net-work, but actually in very large meshes, to effect which they fork out several times into two or three branches and anastomose by inosculation.

These facts rest on the clearest evidence, being easily proved even with a magnifying power of 100 diameters. The semifluid nervous substance contained in these elementary tubes may be made to flow out, and be seen to penetrate into each of their subdivisions and anastomoses. These anastomotic terminations of the elementary nervous tubes have already been proved to exist by Savi, in his "Anatomical Investigation of the Torpedo (1844)." He has also proved this fact in the partitions which separate the discs of gelatinous substance of the electric apparatus of this fish.

The last facts which I have just established exhibit a still greater analogy between the organ in question and the apparatus of the electric fishes. It is true that these nerves proceed from the termination of the spinal marrow, that is to say, from the *cauda equina*, but the same fact takes place in the *Gymnotus*, the most potent in its discharges of the electrical fishes, whose electrical organs however, according to Hunter, do not receive a mass of nerves proportionably so considerable as those of the Torpedo. In the Ray, as in the *Gymnotus*, the mass of the nerves sent to the electric apparatus by each nervous pair, is at least as considerable as those which they transmit to the skin and the muscles. The lateral nerve does not in the Ray, any more than in the *Gymnotus*, send any filament to the organ in question.

The nerves of the electrical apparatus of the *Silurus*, examined by Geoffroy St. Hilaire, M. Valenciennes, Rudolphi and Peters, proceed from the lateral nerve, a branch of the eighth pair.

Thus there is nothing constant in the origin of the nerves of the electrical apparatus, as they proceed sometimes from the eighth and ninth pair (*Torpedo*), sometimes from the eighth pair alone (*Silurus*), sometimes from the pairs which arise from the spinal marrow (*Gymnotus* and *Raia*). Their situation has also no constancy, as they are sometimes situated towards the head (*Torpedo*), around the body (*Silurus*), and on each side of the tail (*Gymnotus* and *Raia*).

The vessels of this organ are numerous and curiously arranged. Between the articulation of each vertebra there passes a vessel, alternately an artery and a vein, proceeding from the principal

artery and vein of the tail. These two vessels never pass together to reach their foramina, and they never traverse the inferior spinal apophyses, like the nerves, to issue from the spinal canal. Beyond the vertebræ, the vessels follow the course of the nerves, and penetrate with them into the apparatus. Several branches ramify on its surface, surround it with their anastomoses, and from the plexus which they form, some branches are detached, destined either for the skin or the adjoining muscles.

Those vessels which penetrate the thickness of the organ are there subdivided infinitely in the partitions of connective tissue which separate the discs from one another.

From the plexus formed by the arterial and venous ramifications capillaries are given off, which are directed towards the posterior face of the disc which is in front of them, and penetrate into its substance. A capillary vessel never penetrates into the anterior surface of a prism; but we have stated that the nerves ramify opposite to or against that surface. The capillaries which penetrate the discs are very elegantly arranged in flexuous loops, and are sometimes agglomerated in the form of tufts. These loops and tufts are lodged and buried in the cavities by which the disc is hollowed out; these excavations exist only on the posterior face of the discs, whilst the anterior face against which the nerves are arranged is smooth. The capillaries which are buried in the discs are from $\frac{1}{10}$ to $\frac{1}{25}$ of a millimetre in diameter.

To sum up the matter, there exists in the Rays a pretty voluminous organ, situated in the tail of that fish, as in that of the *Gymnotus*. [From a letter which I have received from Prof. J. Müller, Rüppell would appear to have described an organ analogous to the former in the tail of the fishes of the genus *Mormyrus*.] This organ of the Rays receives fine but very numerous nerves. It is formed of a gelatinous semitransparent and firm matter, as in all the electrical organs known. This substance is, as in all these fishes, divided into polygonal discs, regularly piled together, against which nerves ramify that terminate by successive bifurcations and anastomoses supplied from their elementary fibres. How can we help seeing in this an electrical apparatus? It is true that its position is not the same as in the Torpedo, but in the *Gymnotus* and the *Silurus* the organ is also situated in the tail or around the body. These conclusions are further confirmed by the following facts: I have proved that this apparatus is wanting in the tail of the Torpedo and the genera *Mustelus*, *Scyllium*, *Squatina*, *Zygæna*, *Acanthias* and *Carcharias*.

The presence of this apparatus in the tail of the Rays explains the immoderate proportional length of this organ, its flattened form beneath, and the absence of the inferior lobe on the caudal

fin, which scarcely exists in the Rays. The anal fin is also wanting in the Rays, it is also wanting in the Torpedos; but all these fishes have a complete caudal fin, whereas it is wanting in the Rays, as I have just observed.

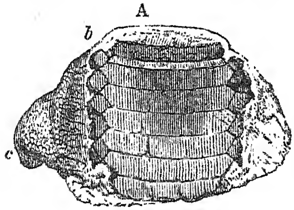
I am indebted to the kindness of M. Bibron for being enabled to ascertain that the other fishes allied to the Rays (*Cephaloptera*, *Myliobates* and *Pastinacus*) whose tail is terminated by a thin and extended whip or prolongation, do not possess this apparatus. The whip is formed of a portion of the tail, which the electrical apparatus would occupy if it existed.

As we have just seen, this organ cannot be regarded as a gland, for it has not the structure of one; it does not possess an excretory duct, it does not communicate in any part with the inside, and no gland receives so many nerves of animal life*.

IV.—*Notice of an Ichthyolite from Sheppey, in the collection of Mr. Tennant, F.G.S.* By Prof. Owen, F.R.S.

The unfrequency of the discovery of any part of the internal skeleton of the cartilaginous fishes associated in a fossil state with the teeth, which are the most common evidences of the extinct *Chondropterygii*, induces me to send the following description of the Ichthyolite figured in cuts A and B, which has been kindly transmitted to me for that purpose by Mr. Tennant, F.G.S. It was found in the well-known and rich fossiliferous deposit of London-clay at the Isle of Sheppey, and consists of a portion of the premandibular bone (*c*) with six of the large median (*a*) and a few of the small lateral (*b*) dental plates of the extinct species of Eagle-ray, called by M. Agassiz '*Myliobates striatus.*'

A



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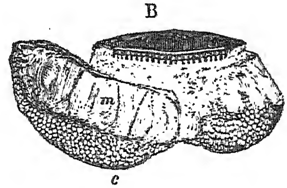


Fossil under jaw of *Myliobates striatus.*

The first appearance likely to attract attention in the portion of lower jaw here preserved is that of a large medullary cavity at

* Nevertheless the proof of its being an electrical organ must depend upon its power of giving electric shocks. Such a property, in our common Rays, if it existed, could hardly have escaped the notice of fishermen, in the constant habit of handling large Rays, Skates and Thornbacks immediately after their capture.—Ed.

m, fig. B, an appearance affecting at first sight a general character attributed to the bones of fishes *, and apparently at variance with the known laws of development of the osseous tissue in the existing members of the class.

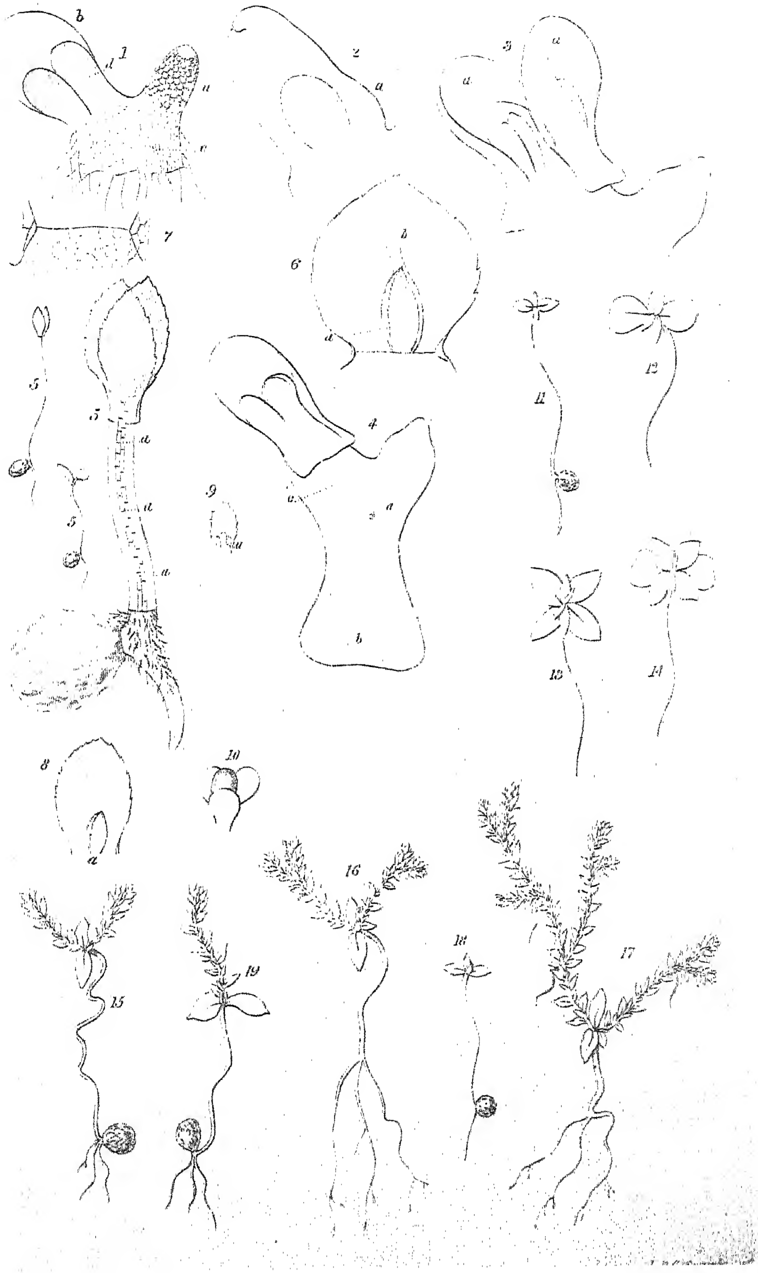
In most Vertebrata, as is well known to physiologists, extension of parts is not the sole process which takes place in the growth of bone: to adapt the bone to its destined office, changes are wrought in it by the absorption of parts previously formed, chiefly in the interior. In the growth of the bones of fishes such internal changes have not been observed, and hence the character assigned to them by Prof. M. Edwards; and in point of fact, most of the bones of recent fishes are solid or spongy in their interior. The bones of the Chelonia are likewise solid: a coarse diploë fills the interior of the long bones of the extremities, and we find a similar structure in the bones of the *Cetacea* and *Phocidæ*. Among terrestrial mammals also, the inactive Sloths, both recent † and extinct ‡, have the long bones of the extremities solid; whilst the agile Antelopes have their diaphyses in the condition of hollow columns; the strength and lightness of the bones being increased by the progressive absorption of the first-formed osseous substance, which is removed from within as new bone is deposited from without. The ribs of the large Ophidians, which serve them as legs, have likewise their medullary cavities; and the bodies of the vertebræ of some Lizards, and of the great extinct *Poikilopleuron*, are similarly excavated. These medullary cavities become filled with spar or matrix in fossil marrow-bones: and the same infiltration of foreign matter in the cavities of such bones of cartilaginous fishes, as the jaw of the *Myliobates* here described, might seem to indicate that there had been an original formation of a medullary cavity in it by the action of the absorbents on a primitively solid bone. This however is not the case: in most *Chondropterygii* an osseous crust is formed upon the periphery of the original cartilage; the crust consists, as in the fossil (figs. A, B, *c*), of prismatic pieces, which under the microscope present oval calcigerous cells about $\frac{1}{500}$th of an inch in diameter, but without conspicuous radiating tubes: the ossicles closely resemble in tissue the plates and tubercles (placoid scales) on the integument; but in the fossil this tessellated crust of bone may be traced passing beneath the posterior dental plates.

The cavities which such partially ossified bones of fishes appear, when seen in the fossil state, to have had while recent, were

* "Les os ne présentent jamais de canal médullaire," Milne Edwards, Elémens de Zoologie, Classe des Poissons, p. 690, 1834.

† De Blainville, Ostéographie de Paresseux, p. 1.

‡ Owen, Memoir on the Mylodon, 4to, pp. 83, 112.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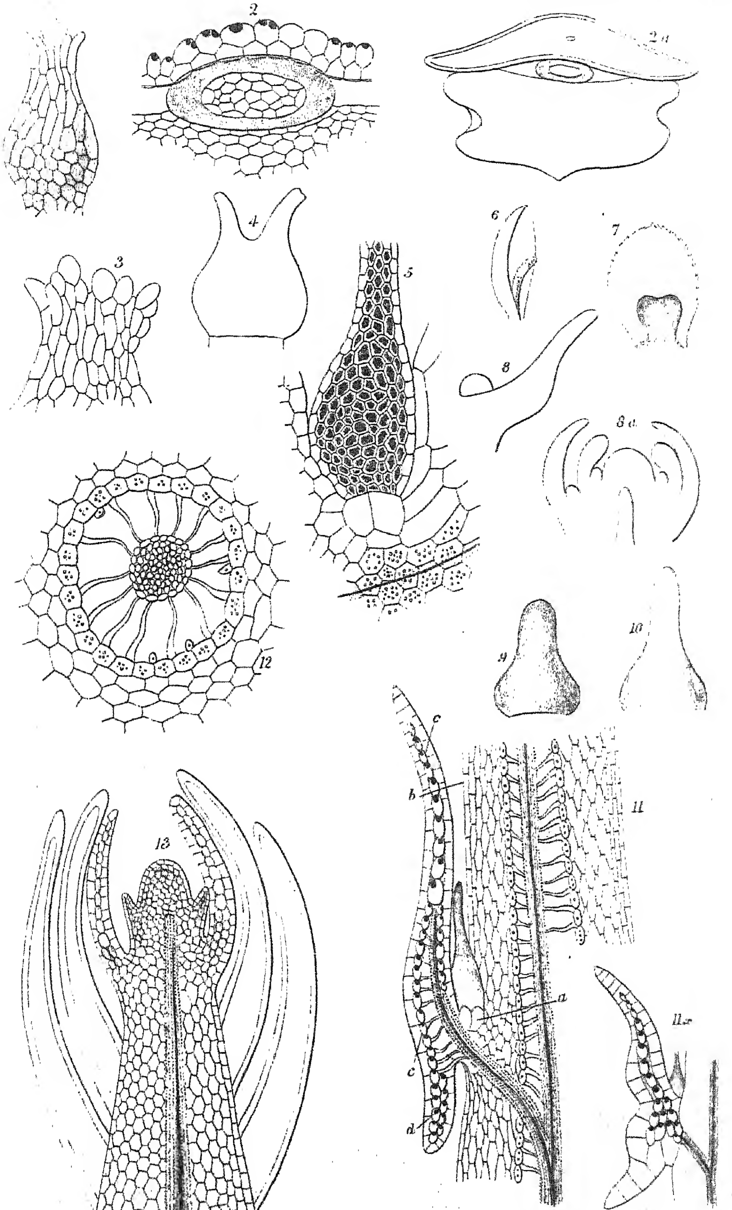
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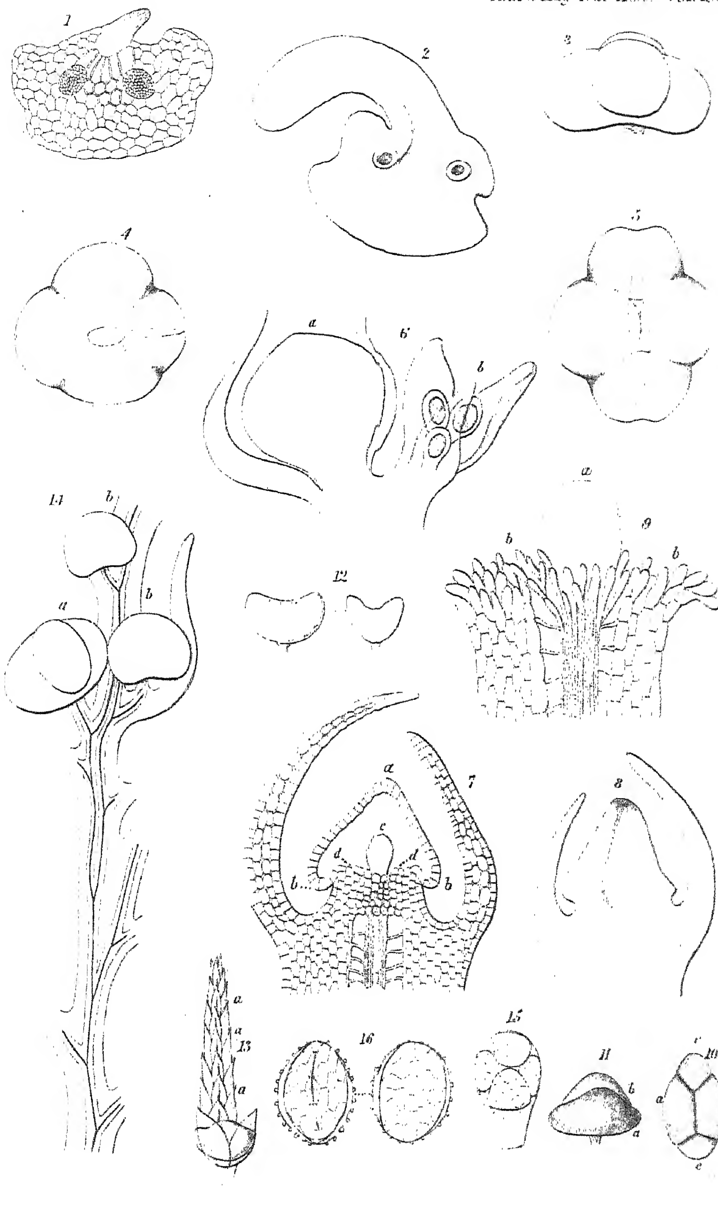

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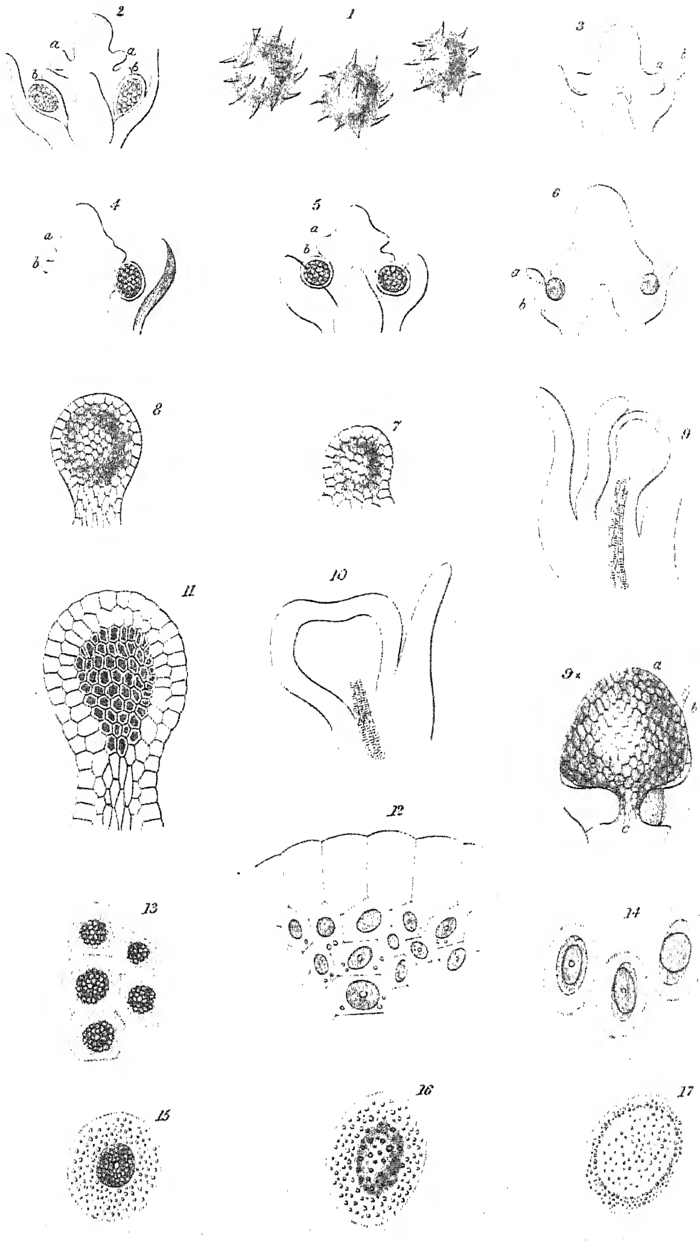
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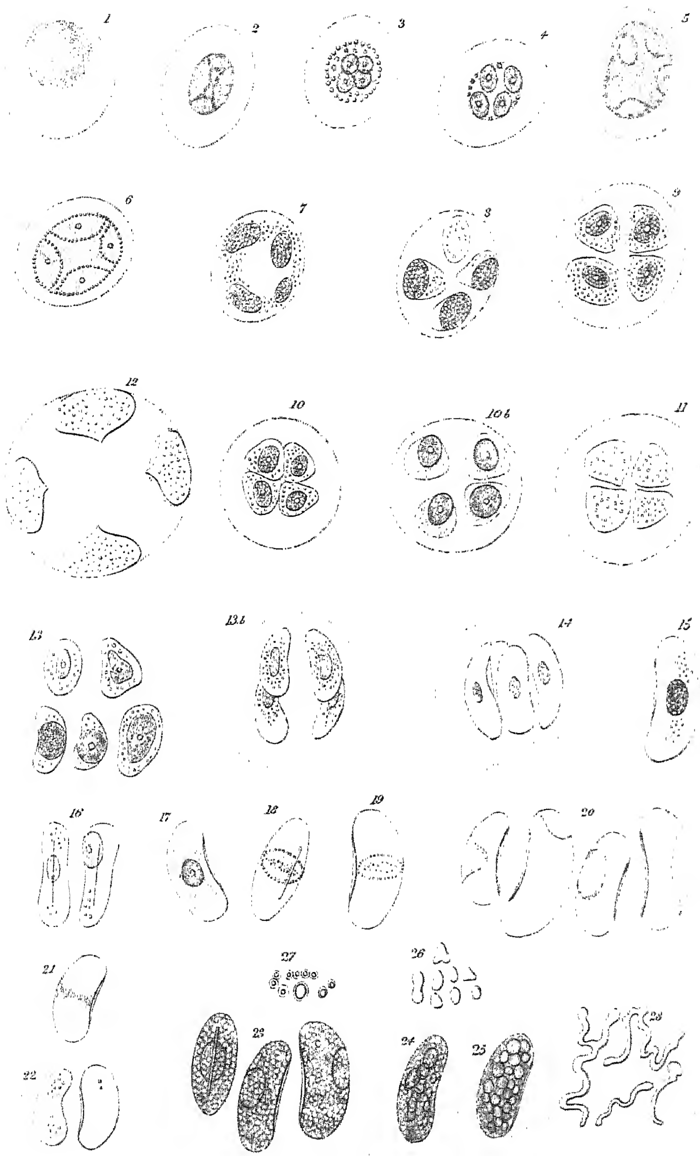
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J. D. C. Sowerby

actually then occupied by the clear unossified cartilaginous basis of the bone, and not by marrow. The non-medullary character, therefore, assigned to fishes from the texture of their bones is strictly accurate. They may have cavities, but these are never occupied, as in higher classes, by marrow. The persistent cartilaginous basis of such partially ossified bones of fishes differs in chemical composition from the temporary cartilage of the bones of reptiles, birds and mammals, as Prof. Müller has shown *. It bears a closer resemblance to mucus: it requires a thousand times its weight of boiling water for its solution, and is neither precipitated by infusion of galls, nor yields any gelatine upon evaporation.

I have been induced to offer the foregoing comments on Mr. Tennant's Ichthyolite from having been asked more than once to explain the seeming contradiction given by such fossils to the law of the absence of medullary cavities in the bones of fishes, and from the circumstance of there being no precise explanation of the appearance, in reference to the cavities in the bones of higher Vertebrata, in the classical work of M. Agassiz on fossil fishes.

V.—*On the Development of the* Lycopodiaceæ. By Karl Müller †.

[With five Plates.]

§ 1. *Literature.*

The most complete researches on this interesting family which have hitherto been presented to us are certainly those of Bischoff, which he published in his 'Cryptogamische Gewächse ‡.' Since that time however the position of science has undergone such an important change, that in this family also questions have arisen which remain to be solved. Toward the attainment of this end the present memoir is contributed. I know well that there is yet many a gap to be filled up here, still I am induced to publish my observations in their present condition, as I believe them to be conclusive in reference to many points.

The history of this family up to the time of Bischoff has been given by him in his above-mentioned work. This relieves me from the necessity of entering upon it here. What has been done since, is chiefly confined to their systematic arrangement,

* See his admirable memoir, 'Ueber die Myxinoiden,' in the Berlin Transactions for 1835.

† From the 'Botanische Zeitung,' July 31, and August 7, 1846. Translated by Arthur Henfrey, F.L.S. &c.

‡ 2te Lieferung, Nuremberg, 1828.

and on this point Spring's observations are the most important. His labours are to be found in the 'Flora' Journal, 1838, and in the 'Fl. Brasiliensis,' pp. 106—135. I am not acquainted with a treatise of Link's, which Schleiden cites in the first edition of his 'Grundzüge, &c.*,' but it appears of very little importance to my purpose. In another memoir however by H. von Mohl†, an attempt is made to open a new path, which will be spoken of hereafter in the places bearing reference to it. Other critical observations are given by Schleiden in his work already mentioned‡. Nothing connected, therefore, seems to have appeared upon the *Lycopodiaceæ*.

§ 2. *The Germinative Spore.*

It is well known that two kinds of spore-cases are distinguishable in the *Lycopodiaceæ*,—1. for those capable of germination, and 2. for others which apparently have no share in the reproduction. Spring calls the former *Oophoridia,* the latter *Antheridia.* In the latter expression Spring indicates no more than a morphological opposition to the Oophoridia; he did not entertain any idea of a sexual distinction§. The essential points relating to both sporangia have been long known; Bischoff has given accurate illustrations of them in his work above-mentioned. We have here therefore only to do with the spore which germinates, the development of which I have traced, as also did Bischoff, in *Lycopodium denticulatum.*

This exhibits, on the whole, a great conformity of structure in the different species in which it makes its appearance. They are more or less roundish bodies, which on those surfaces which have been in apposition with each other in the *oophoridium,* are flattened just like the smaller pollen-like spores. Therefore, since only three or four spores are contained in one of these capsules, they are spherical on the outer surfaces, that is, where they are not in contact, and on the inner side have three or four triangular faces. This is particularly distinct in *L. selaginoides,* and also in *L. denticulatum.* In others they are often quite round, for instance in *L. articulatum* and *pygmæum.*

A transverse section distinctly shows that they possess two

* Part 2. p. 82.

† Morphologische Betracht. über das Sporang. der mit Gefässen versehenen Kryptogamen. Tubingen, 1837, p. 28, &c.

‡ 2 Th. pp. 79—83. I have here usually cited the first edition, since this is probably now in the hands of most botanists. The second contains nothing new relating to this family.

§ At least I so understand Spring's words: "capsulas fariniferas et globuliferas non de essentia sed per accidens solummodo esse diversas neutiquam credo. Est omnino antithesis inter ipsas, *sexuali analogo,* licet non *eadem.*" (See Fl. I. Bras. fasc. 7. pp. 106—108.)

coats. The exterior is very thick and made up of numerous cells, the walls of which are wholly confused together, so that they are often scarcely perceptible on the surface of the section. This thickening is common to the whole coat, the cells of which, by the incessant deposition of new matter in their interior, become homogeneous plates. Yet some species differ so much in this respect, that the cells are not completely thickened, but still exhibit some cavities, as in *L. articulatum*. The continued deposition of membranous substance usually causes the external coat of the spore to exhibit elevations on its outer surface. They occur especially upon walls of the cells as anastomosing ridges of irregular form (*L. articulatum*); in other spores where the walls of the cells have become almost indistinguishable, as wart-like bodies (*L. selaginoides*), or as large, compact papillæ (*L. pygmæum*). In *L. articulatum* there are, besides these larger elevations, still smaller papillæ scattered over the whole surface. They constitute a special thin membrane which may be detached from the cells lying beneath.

The *inner membrane* on the contrary is *usually* perfectly structureless and of equal thickness in all parts; it is not so firmly adherent to the outer membrane as to prevent its being detached from it. I have only found the inner membrane different from this in the spore of a single species, namely in *L. gracillimum*, that is indeed if I did not confound it with the outer membrane, which I do not believe. In this case, beneath the outer thick membrane lies a layer of *parenchymatous cells* of *tolerable size*, which could be separated from the former. I saw nothing of any other layer, like that which is present as the inner membrane in all the other spores; this therefore must be regarded as the peculiar inner layer, although it is not clear to me how this inner membrane can consist of an independent layer of cells.

In general this membrane is formed of a more or less granular substance, which is particularly evident in *L. articulatum*.

The contents of these spores consist of a granular mass which is contained free within the inner membrane. The granules are perfectly round, distinct from one another, transparent and of very variable though always small size. They still remain in this condition after being kept for years, as I can state, in confirmation of Bischoff, with regard to *L. selaginoides*. This inquirer says* of them, that they appeared to him to consist of vesicular cells, and following him, Schleiden † speaks also of a delicate cellular tissue. On the other hand, I must remark, that to me these granules appeared to be not nearly so like small cells as compact grains, since on treating them with strong tincture of

* *Ut sup.* p. 110. † Grundz. ii. p. 82. ed. 1.

iodine I could not detect any ring in their interior, and this is the first character of a hollow globule. But there can be no question at all of a cellular tissue here, and this can only be a misconception. A fluid which appears to be oily accompanies the granules at a later period, and this will be more fully spoken of hereafter.

§ 3. *The process of Germination.*

When the spore escapes from the sporangium and falls upon a suitable soil (which must be somewhat moist), it swells out by absorbing water into its interior. If we examine under the microscope a spore in this stage, on crushing or cutting it the granular matter contained is readily spread through the water upon the slip of glass, and is evidently accompanied by the apparently oily fluid already mentioned. This is also scattered through the water in the form of drops or globules of oil. To satisfy myself whether I had to do here with actual globules of oil which have *but too frequently* been described by various inquirers as forming part of the cell-contents, or with some other substance, I next endeavoured to test them with very strong solution of iodine. By the application of this, the mass became brown, firmer and more tenacious. I then added æther, and the globules were not dissolved, as must have been the case if they really consisted of a fatty matter. The mass remained tough. Moreover it still remained so when I applied hydrochloric acid, and distinctly showed by this that I had to do with a totally different substance. It is already present before the formation of cells begins and is the material for that operation, therefore I do not doubt in the least that it is the same mass which H. Mohl has briefly characterized under the very expressive name of *Protoplasma* in the 'Botanische Zeitung' (vol. iv. p. 75*).

If the process of cell-formation has already begun, when we carefully examine a spore, we find that as soon as we act upon it with iodine, some free cells always show themselves among the remainder of the cell-contents and the protoplasma, and are always coloured blue. They appear more or less round, compressed on two sides or angular, most of them however in the laterally compressed form. In the centre occurs a roundish, smaller nucleus inclosed in a coagulated mass, but in such a manner that it always appears round. Other layers, surrounding this, now present themselves, which are concentrically situated around the nucleus, and are likewise coloured blue. A gelatinous, coagulated and thicker layer envelopes the whole in the form of a cell, which therefore wholly identifies itself with an

* Annals Nat. Hist. vol. xviii. p. 3.

"amylum-cell." I regard it in fact as actually such, and likewise as one of the earliest stages of cell-formation. They soon lose the character of amylum-cells, since they become transformed into another substance which is coloured brown by iodine, and which again wholly incloses the nucleus like the protoplasma, only in another situation, as I shall at once show further on.

I must here however make mention of a peculiar phænomenon which remains totally inexplicable to me. When I treated these cells with iodine, æther and hydrochloric acid, I found that their deep indigo blue colour was changed and they became reddish or even wholly colourless. When I now touched the fluid in which they swam, the slight agitation instantly restored the blue colour. In a state of rest however this soon disappeared again, and reappeared when the fluid was touched, and so on. But if the cells had become quite colourless, immediate contact with some object, either of metal or wood, was necessary, and then the blue colour again instantly seized upon one point—it appeared to me to be the nucleus—and extended itself over the whole cell. I have met with this remarkable phænomenon in two spores. In spite of every endeavour I have not hitherto been able to find it again, although I have applied an infinite variety of mixtures of the three reagents, and also used the hydrochloric acid first and the others afterwards, or these first and that last. It is possible that a peculiar stage of the life of the cell may be here requisite, which therefore I have not again lighted on. I remark however expressly, that I found this changing of colour in all the blue-coloured cells of those two cells, and consequently it cannot be attributed to any optical illusion, and so much the less that I could continue this play of colour as long as I liked. Perhaps some one else may succeed in observing this phænomenon in similar cells and by more close observation discover the law, and it is for this reason that I have here called attention to it.

In the interior of the perfect young cell is found a collection of that granular substance which has been already described as the spore-contents, or only a single large granule as a nucleus, always in the centre. Around it, as has been stated above, a substance similar to, probably identical with the protoplasma, has already been evenly deposited, the outer contour of which, firmer than the inner substance, forms the whole into a cell. The protoplasma has been thus equably deposited round the granules, because these lie exactly in the centre of the cell, and this position is an evidence of the importance of the granules for cell-formation. They are, as often in the process of crystallization, only the point of attachment, and thus the special foundation for the substance deposited around them, just as we explain the forma-

tion of the oolite limestone or urinary calculi, &c., the nucleus of which is a granule, which is afterwards to be found in the centre. This analogy is the more striking here, since in these amylum-cells the contents have been likewise deposited concentrically around the nucleus, as in these crystalline formations. Some authors draw a parallel between the processes of cell-formation and crystallization, and in fact I see no reason to object to this view.

From these observations this cell-formation appears to be somewhat different from the usual kind depending on cytoblasts. Here we have no cytoblasts but only a simple nucleus as a central organ; around this the protoplasma is deposited till the outermost surface hardens; in the other formation, protoplasma is indeed similarly deposited round a nucleus and so forms the cytoblast and *through this* a cell, but then the process is of somewhat longer duration, as the outer surface of the cytoblast must first become softened and extended to form a membrane, while in the other case such solution and extension does not take place, and the outer surface of the protoplasma is immediately transformed into "membrane substance." Thus we can, if we like, with perfect right in our case, call the cells *cytoblasts* which develope directly into cells, since they soon become hollow, although the protoplasma is not perceptible without the addition of iodine. As a whole however it comes to the same thing, with this distinction only, that in one case the protoplasma is not precipitated, as in the cytoblast, in the form of a granular and distinctly visible, compact mass. In both cases the nucleus is to be considered as the central organ, as therefore especially the basis of cell-formation. The cells now become hollow by the absorption of the protoplasma. This does not take place quite completely at first, for, exactly as in the cytoblasts, the nucleus comes to be suspended in the centre by thin, persisting filaments of protoplasma, till at last both filaments and nucleus disappear.

Thus these observations wholly agree with Mohl's so far, as here the protoplasma is deposited round the nucleus exactly as he describes. The formation of membrane alone by the direct hardening of the outer surface of the protoplasma deposited round the nucleus appears to be a new modification of cell-formation. I am the less inclined to believe myself deceived here, since I could never find any true cytoblasts, and I saw that the cells were already filled with protoplasma in their earliest stage. I must particularly remark, that the earliest cells inside the spore certainly originate independently. I never found secondary-cells within parent-cells.

This formation of cells commences at a particular spot on the inner spore-membrane. The spot is characterized by the fact

that the membrane upon which the cells are deposited are coloured blue by iodine, while the rest of the surface becomes brown. It is consequently partly altered chemically and indeed into a substance containing starch. It is thus qualified for its further extension, since being more porous than the rest of the membrane it can more readily acquire new parts by interstitial deposition. The cells apply themselves so firmly upon this spot, that they appear to grow together with the inner membrane.

Lastly, the firm outer spore-membrane is broken through, since the bud grows out from the interior of the spore in the form of a blunt, rounded cone. I distinguish it here by the name *germ* (*Keimkörper*). Its cells are yet quite white and transparent. The place however where the outer spore-membrane opens, is, according to Bischoff, always where the three elevated ridges meet, consequently at the point of union of the three triangular faces of the spore.

At this period the process of germination begins to be visible externally. But the whole of the contents of the spore are not yet by any means transformed into cells; on the contrary, the "germ" is yet of very small circumference, and more or less truncated at its base in the interior (Pl. II. fig. 4 *b*).

If the spore-membrane is first ruptured and the primary germ drawn out, it exhibits a growth in two opposite directions. One indicates the formation of the stem and the foliaceous organs, the other the formation of a rootlet. The former appear in the shape of an ovate mass, the latter as a little cone. Both stand quite upright upon the perpendicular spore (Pl. II. fig. 1). Subsequently they both are curved into a much more horizontal direction, so that, since the stem and root come to be placed exactly on a level, the spore becomes transposed into a horizontal position (Pl. II. figs. 5, 11, 13, 15—19). This position only alters, if the elongating stem subsequently becomes irregularly curved.

If we now examine more closely the whole development, we have here to consider four masses visibly distinct from each other: 1. *the germ*; 2. *the rootlets*; 3. *the stem*, and 4. *the terminal bud*, which organs will be treated of in the following paragraphs.

§ 4. *The Germinating Plant.*

1. *The germ* (*Keimkörper*). This body is composed of an assemblage of very small, parenchymatous and transparent cells, rising to the height of a few lines above the spore, and is here provided with many little radicle fibrils which are merely elongated cells of the outer surface (Pl. II. fig. 1). Within the spore, its base is truncated (fig. 4), and it does not become per-

fectly round until a later period, when it gradually produces a number of new cells upon the base. This however takes place but slowly, and it is seldom that the whole contents of the spore become completely transformed into cells before the plant has attained a condition in which its self-sustaining power has become tolerably evident. Considered in connection with the plant, the "germ" in its perfect condition is pear-shaped, a neck being formed where it breaks through, and rises from the spore (fig. 4 *a*). At a later period it disappears, apparently through decomposition.

2. *The rootlet.* This first appears, as I have already said, under the form of a little conical process (fig. 1). Its substance originally consists of an apparently structureless, undeveloped deposit of roundish granules which appear of a somewhat reddish colour. The apex however of the radicle is more transparent. It soon grows longer, forms parenchymatous, elongated tissue, and many of its epidermal cells become radicle fibrils. The inferior extremity still remains, as at first, more transparent, *i. e.* having the reddish substance and the brighter point, which is indeed the condition of newly-formed parts generally. I have never been able to find any little spongy investment upon this end, and I therefore know not what Bischoff alluded to under this character. I have seen a number of radicles in all stages, and have carefully examined them under the microscope; but an organ of this kind, such as we find in *Lemna,* never presented itself to me. As to the vessels, which the root subsequently exhibits, they are formed after those of the stem. The growth of the root generally is slower than that of the last-named organ.

The subsequent course of development of the radicle is an elongation and dichotomous ramification. As soon as the plant has become more independent, several roots are developed at the base of the stem, and these present characters exactly similar to those of the first. Like this they originate from the extension of the "germ," and by their frequent occurrence on the same point of attachment they render it very doubtful whether we ought to consider the root first developed as a chief root (*Hauptwurzel*) as Schleiden does*. It is indistinguishable from those subsequently produced, and only has the advantage over them in the fact that it is the first formed and is on a level with (its axis corresponding with that of) the stem. The only question is therefore how much importance is to be attached to this last circumstance.

The radicle fibrils subsequently appearing upon the foliaceous branches do not differ from these roots in their structure and development. But these cannot be spoken of until we come to the formation of branches.

* Gründzuge, ed. 1. ii. 79.

3. *The stem.* The future situation of this is very evident in the "germ" as a dark, circular expanded spot. This occurs near the middle, and consists of cells filled with material for development (Pl. II. fig. 4 *a*). This is the special point of vegetation for stem and root, and the boundary of the germ. By the time indeed that the stem has become so far visible that we can distinguish clearly in the main axis, a terminal bud and an inferior, cylindrical, cellular portion (the stem itself), the vessels of the stem and the terminal bud have already set out from that spot. At a subsequent period the vessels of the root also originate at the same place; so that this organ must be accounted part of the main axis, notwithstanding that its originally erect and independent development, apparently unconnected with that of the bud of the stem, appears to indicate the contrary.

The number of the vessels always amounts to two. This number indeed occurs almost universally in *Lycopod. denticulatum*, since both the roots and the subsequently formed branches divide dichotomously. At a later period, it is true, these two vessels appear to become blended, but this union is only apparent, and in the perfect stem the two orifices of the vessels are always easily demonstrable in a transverse section.

In their first stage they decidedly contain air, since when we bring a stem at this period of its development under the microscope, the vascular bundle appears all dark and filled with air-bubbles (fig. 5 *a*). This arises probably from the circumstance, that as the germinating plant lies in water, the latter penetrates to a certain extent, accumulates in particular places among the air contained in the vessels, and thus somewhat compresses it. This is the more likely, since the vessel soon becomes so filled with water, which could only be taken up through endosmose, that the air is completely driven out, or perhaps in great part mixed with the fluid.

This stem now constitutes the whole of the as yet undivided, main axis, and may thus be clearly distinguished from the branches next produced. What the condition of this may be in the other *Lycopodia* which do not belong to the genus *Selaginella*, I am unable to say. It elongates only up to a certain limit, while the terminal bud is becoming perfected at its apex.

4. *The terminal bud.* When the stem is only just distinguishable, this organ is found upon it as a little head, of ovate form and of a green colour. Within appear distinctly two, much smaller, ovate bodies, situated opposite one another, which are visible through the external, green envelope (fig. 1 *d*, fig. 2 *a*, a lateral view), in which one body is in front of the other, and so only one is visible.

Examined more narrowly, the terminal bud is seen to consist

of two outer leaves, which are so closely united that they may be said to fit one another like the two hollow hemispheres of a bullet-mould (fig. 3 *a*, where they are separated to some extent by slight pressure between two glass plates). I distinguish them by the name of "*bud-envelopes*" (*Knospenhüllblätter*), because the two inner bodies which they inclose are already in fact two *buds*, in which may be found the types of the complete organs of the future branches. They are therefore two *buds of ramification* (*Astknospen*). A vessel in course of development proceeds toward each of them from the point of vegetation of the stem (Pl. II. fig. 4 *c*).

Since however all the organs have already been contemporaneously produced in the youngest condition in which it becomes visible to us, I prefer to describe them in a somewhat more advanced stage of development, because at their first production the individual organs are too minute, to allow of our giving a sufficiently clear representation of them, since it is scarcely possible to prepare them for examination.

a. The bud-envelopes. They are broad, somewhat oval, almost roundish and having transparent denticulations on the borders, in other parts of a green colour, and in all these characters quite indistinguishable from the leaves of the branches which succeed. They possess but one character which does not and indeed cannot belong to the leaves of the branches. They possess, namely at their base, which, broader than that of the branch leaves, half embraces the stem, a thin, membranous, transparent, cellular membrane, which also half incloses the stem, and usually appears as if torn more or less regularly at the truncated base. This is not organically connected with the stem, but only an appendage to the "bud-envelopes" (figs. 5—7).

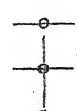
I regard this appendicular membrane as a remnant of the internal spore-membrane. For this does not become detached from the terminal bud until after a considerable period, and then remains with its upper portion (on which, as I have already said, the primary cells of the "germ" are so closely applied that they grow together with it) also further organically connected with the base of the "bud-envelopes," until the developing stem in the course of its elongation tears through the spore-membrane, exactly like the calyptra and vagina of the Mosses, where, as here, the lower portion remains attached to the base of the axis, while the superior portion is carried upwards. This explanation is confirmed by the fact that this membrane always looks as if it had been torn, and the other portion of the spore-membrane is still to be observed upon the base of the young stem (fig. 5). It is however cellular, while the remaining portion of the spore-membrane consists of a homogeneous membrane, and this appears to

me to arise from the following circumstances: those cells which were originally produced in the spore and became organically connected with the spore-membrane, belong peculiarly to this last structure and form a special membrane upon the inner coat of the spore as it becomes attenuated by its external prolongation, for they have a flattened form and must be regarded as belonging to the spore-membrane only, since they are perfectly free and distinct from the other cells of the "germ." In fact the whole course of development exhibits it in this light.

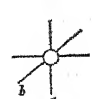
That these "bud-envelopes" were formerly regarded as actual cotyledonary leaves, may be accounted for to a certain extent, by the *long* time during which they remain visible upon the young plant. But they cannot naturally be compared to cotyledons, since they proceed from no embryo, and are in no wise different from the leaves of the branches. But they have the same function on the young "germ," as cotyledonary leaves, to nurse, that is, to defend the young buds of ramification, until they have attained a self-sustaining degree of development.

b. The buds of ramification. As soon as the "bud-envelopes" unfold, *i. e.* have become turned back, the buds of the future branches may be very distinctly perceived between them, opposite to each other. Each occurs in the middle of the leaf, and placed in such a manner that its side is turned toward the internal cavity of its enveloping leaf (fig. 6 *a*). Therefore when by their further unfolding the two buds become turned outwards in opposite directions, a cruciform arrangement is produced with the "bud-envelopes" (fig. 11). Every leaf which is inclosed in the bud follows the same course. If we examine, with a view to ascertain this, the bud represented in fig. 6, and unfold it, another leaf presents itself (fig. 8), which, hollow and folded upon itself, may contain yet more according as the bud has become developed, till at last we reach the axis on which the leaves are produced (figs. 9, 10). The development of these leaves I prefer to describe as seen in the perfect plant.

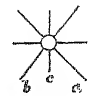
The unfolding of the leaves takes place according to the following plan:—



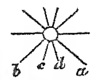
1. Two "bud-envelopes" (fig. 5).
2. Two *branch*-leaves. These deviate 90° from the first, and form a cross with them (fig. 11) *a*.
3. Two leaves, which again cross the cross already formed. They stand therefore at an angle of about 45° from the "bud-envelopes," and are at this period the smallest leaves of the bud distinguishable by unassisted vision (fig. 12) *b*.



4. This arrangement does not long persist, for two new leaves arise between the last two *c*, and affect the position of the remainder, so that *a* is pushed aside to the extent of 45°. *c* stands almost exactly at an angle of 90° with the bud-envelopes (fig. 13).



5. Then two more leaves appear in each bud which deviate almost equally about 90° *d*.



The alternation of the first two leaves *a b* may already be remarked here, whereof *b* is placed higher up on the axis of the branch than *a*. Both are attached to the lower side of the axis, and are the larger leaves. *c* and *d*, on the contrary, are developed upon the upper side of the axis of the branch, and are here (in *L. denticulatum*), as almost universally in *Selaginella*, smaller than the preceding. Spring calls them *folia intermedia*.

Between the last and first leaves lies the axis of the branch, which now becomes elongated, while in the next place two other larger leaves become visible, whereupon two *folia intermedia* appear on the upper side, &c.

Four series of leaves therefore are now distinctly visible upon the axis of the branch, two above and two below. Of these four series two on one side always correspond so with each other, that first a large leaf is situated on the under, and a *folium intermedium* at some distance on the upper side. But if all four series are now compared, a *folium intermedium* is normally opposite a large leaf situated on the other (under) side (figs. 15—18); consequently two series of leaves always alternate with each other.

The two opposite buds developing in this manner, the germinating plant becomes bifurcated. But one of the buds is sometimes abortive, and then of course there is no bifurcation; the single bud developes into a branch, and this subsequently undergoes a bifurcate division (Pl. II. figs. 18, 19).

c. Accessory organ. I come now to an organ which is contained in the terminal bud and contemporaneously formed, and which, so far as I know, has never hitherto been observed. It appears to me that it must be of importance to the plant, since its occurrence is constant.

It is a body, usually pyriform, composed of a number of delicate, transparent, parenchymatous cells. It is consequently bellied out at its base and attenuated into a neck above (Pl. III. fig. 1). It is compressed on two sides, but in such a manner that its borders are not acute, but rounded (fig. 2). The borders are entire, and the apex alone, which is always truncated, has the uppermost cells irregular and more or less rounded. Within them are parenchymatous cells usually smaller, normally hexa-

gonal, with horizontal walls (figs. 1, 3). The apex of this organ is often bifurcated (fig. 4); the forks however at their apices pass gradually into cells like those we have before met with (figs. 1, 3). By a transverse section we find that the interior also is filled by layers of delicate parenchymatous cells (fig. 2). The same is seen in a longitudinal section (fig. 5), in which it may be clearly perceived, the external layer of cells regularly inclosing the remaining mass of cells. The apex is prolonged out into a few layers of cells (fig. 5); finally into a single one (fig. 1). Moreover the cells of the swollen, expanded base are filled with a finely granular, somewhat reddish matter, which however is only developed here into *membrane-substance,* since it probably forms new cells to multiply the numbers, whereby the bulging circumference of the basis is enlarged. No other kind of cell-contents is present (fig. 1).

This singular organ is present in all stages of the plant's existence. In the terminal bud of the youngest "germ" it is already perfect, and is situated between the bud of the branch and the bud-envelope (Pl. II. fig. 6 *b*). It is again met with in every successive leaf, in the large as well as in the "intermediate." In the terminal bud even of the perfect branch it is produced soon after the development of the leaf from the stem, and is always placed between them. Equally constant is it between the oophoridium and the antheridium and their involucral leaves. It is particularly large between the oophoridium and its involucre.

With respect to the development of this organ, it appears both in the terminal bud of the "germ" and that of the branch as a more or less circular plate (Pl. III. figs. 6, 7, 8, 8 *a*). In the first-named bud its very delicate cells are already filled with that often-mentioned reddish substance, by means of which the organ becomes more extensively developed (figs. 6, 7). In the second the plate is *frequently* quite transparent and devoid of that substance (fig. 8). The plate, now of equal thickness all over, then extends itself upwards into an attenuated neck, rounded at the top (Pl. III. figs. 9, 10). This is usually more transparent than the base of the organ, which also in the leaves of the terminal bud of the branch soon becomes filled with the same reddish contents. Through this elongation, however, the base appears as if thicker; this indeed is quite natural, as it has not yet become extended. But the cells speedily become developed in this part of the organ on the side next to the leaf. By this means the organ acquires a bulging form in this situation (Pl. III. fig. 5 *a*), while the side turned toward the axis of the branch is *usually* much more perpendicular (fig. 5 *b*). As soon as the general form is perfect, the top of the organ becomes

truncated by the cells of this part separating from one another, so that it looks as if it had been torn (figs. 1, 3), and the organ is then perfect. In this shape it continues until the end of the annual growth of the plant, at the end of which period it withers with the leaves, apparently without acquiring any further development, since we never find anything in its interior different from what has already been described.

But the nature of its connexion with the longitudinal axis of the branch is to be seen by making a delicate longitudinal section. In this we observe that it is neither attached to the leaf nor laterally upon the axis of the branch. It stands exactly between the two, and is united by several larger, transparent and empty cells, usually two, with the green parenchyma which passes off from the axis to the leaf. The organ never receives a branch from the vascular bundle, although the vascular bundle, which is given off from the axis to the leaf (figs. 5 *c*, 11 *a*), runs close under it. If at a later period we cautiously detach a leaf with the whole of its base from the stem, we always find upon it, *i. e.* upon its thickened base, this organ removed with it, and it would thence appear as if it really belonged to the leaf and had been formed from the parenchyma of the same; but the history of its development speaks most decidedly against this last view.

It is difficult, with respect to this enigmatical structure, to attain a view which shall give us even an approximation to its real import. Even the history of development here leaves us at fault, and a true solution of this question will probably only be found when we know how widely this structure is extended throughout the Lycopodiaceæ, in how many different forms it appears, and when perhaps anomalies in its mode of formation shall be met with. Meanwhile its analogues appear to me to occur in those buds which are often met with in the axils, between leaf and stem, in various other Cryptogamic plants, as in the axils of the leaves of *Bryum annotinum* and others. Here however it must not be forgotten that in our case the cells never acquire green contents, while those often do. They consequently cannot be regarded as buds. Are they little branches? are they radicle structures? Reasons on both sides may be brought forward, which to me are yet inadequate to solve the question. I commend it therefore to the attention of more skilful investigators.

[To be continued.]

VI.—Drafts for a Fauna Indica.

(*Comprising the Animals of the Himalaya Mountains, those of the Valley of the Indus, of the Provinces of Assam, Sylhet, Tipperah and Arracan, and of Ceylon, with occasional Notices of Species from the neighbouring Countries**.) By Ed. Blyth, Curator of the Asiatic Society's Museum, &c. &c.†

No. 1. The *Columbidæ*, or Pigeons and Doves.

Order IV. Gyratores, *Pr. Bonap.* Gemitores, *McGillivray*.

This consists but of a single family, that of the Pigeons,

Fam. Columbidæ,

which subdivides into three marked subfamilies, viz. *Treroninæ*, or arboreal fruit pigeons; *Gourinæ*, or ground pigeons; and *Columbinæ*, or ordinary pigeons and doves.

Subfam. Treroninæ.

The members of this group are eminently frugivorous and arboreal, scarcely ever descending to the ground, and some perhaps never, unless to drink‡; and in general they are of a green colour, which renders them difficult to discern amid the foliage of trees. They are distinguished from other pigeons (with the sole known exception of *Ectopistes carolinensis*) by having constantly fourteen tail-feathers instead of twelve§. In form of

* The object of publishing the present series of Monographs of various groups of animals, is to elicit, as much as to impart, information that might be incorporated in a general work now in preparation; and it is therefore earnestly requested that observers, interested in the subject, will favour the author with any additional facts or corrections that may occur to them, and that they will also endeavour to settle any questions that are still at issue, and, in short, to render the future conspectus of Indian animals as complete as circumstances will permit of. In the class of Birds, it may be here remarked, that any information on the nidification and colour of the eggs of species generally, and of the song-notes of the smaller *Insessores*, will be particularly acceptable. [The notes marked T. have been supplied by Capt. Tickell, and those marked H.E.S. by Mr. H. E. Strickland.]

† From the Journal of the Asiatic Society of Bengal, no. 169.

‡ An individual of *Treron bicincta* has been seen feeding on the ground, but such instances are extremely rare. *Vide* also description of *Tr. nipalensis*.

§ Perhaps, however, certain of the ground pigeons may also have more than twelve tail-feathers, which remains to be ascertained. In the domestic breed of *fan-tails*, the number is abnormally multiplied to as many as thirty or more. It is very remarkable, that of the two species of *Ectopistes*, which are nearly allied to each other, one should have fourteen tail-feathers, while the other, the celebrated passenger-pigeon of North America, should possess but the usual number—twelve. This fact was observed and recorded by the Prince of Canino.

bill, they present a gradation from the strongest beak that occurs throughout the order, to a feeble organ, soft and tumid to near its tip, which alone is corneous; but the gape, especially in the latter case, is very capacious. The tarsi are short, stout, and more or less feathered; and the toes (except in one subgenus) are remarkably broad-soled, and are furnished with strong and sharp claws, commonly much-hooked; hence they have great power of clasping, or holding on to the small branches of trees, while straining to pluck the fruit or berries from the terminal sprays; so that, when feeding, these birds may be commonly observed to lean over and downward so far as to be inverted, and then draw themselves back by the unaided muscular strength of the extremities. The flight of all is powerful and rapid. Three strongly-marked genera occur, numerous species of which inhabit the warm regions of the Old World, Australia, and Polynesia; but from America they are wholly excluded.

Genus Treron, Vieillot: *Vinago*, Cuvier. (*Hurrial* and *Hurrwa*, H.; *Hurtel*, Beng.; *N'goo*, Arracan.) The Hurrials.

In this genus may be observed the gradation in form of bill that has been adverted to in its full extent; but all the strong-billed species are here included. The plumage is blent and glossless, and almost without exception of a lively green, varied with ashy, and with a stripe of bright yellow on the wings margining their coverts; while the males are commonly further adorned with a deep maroon hue* on the mantle, and with orange, or orange and lilac, on the breast. Irides crimson, with a blue ring encircling the pupil†. The voice a melodious deep-toned whistle, considerably prolonged and varied in different cadences. Nidification as in most other arboreal doves and pigeons, and two white eggs produced, of a somewhat less elongated shape than in common pigeons. Except in the pairing season, these birds collect in small, or moderately large flocks, on the topmost branches of high jungle trees, where, if one can be descried and is shot at, two or three will commonly fall, that had eluded observation from the similarity of their colouring to that of the foliage. They subsist on fruits and berries of all kinds, and during the season especially on the small figs of the *Ficus indica* and *F. religiosa*; and they have likewise been observed "devouring the blossoms and newly-formed fruit of the mangoe

* This hue, in different shades of vinous or claret-colour, occurs in a great number of *Columbidæ*, and has been remarked to be almost peculiar to the tribe.

† A partial exception to this occurs in *Tr. nipalensis* only, among the Indian species; at least, the only two living specimens of this bird which I have seen had dark red-brown irides, with a blue inner circle. Mr. Hodgson describes them as—"outer circle of the iris orange-red, inner circle blue."

and tamarind trees." Their flesh is esteemed for the table, but the skin requires to be removed, this having a strong bitter taste; and hanging them up for a day or two, when the season will permit of it, improves them much for culinary purposes.

It is necessary to distinguish three well-marked subgenera, as follow:—

A. Toria (since altered to *Romeris*), Hodgson. Distinguished by the great strength and vertical depth of the corneous terminal portion of the beak, which, in the typical species, is continued back to beyond the feathers of the forehead. The eyes are surrounded by a naked space.

Tr. nipalensis: *Toria nipalensis*, Hodgson, As. Res. xix. 164. (*T'horya*, quasi *rostrata*, of the Nepalese.) Green, yellowish below and towards the tail; the crown of the head ash-coloured; mantle of the male deep maroon-red, and a faint tinge of fulvous on the breast; primaries and their larger coverts black, the latter margined with yellow; middle tail-feathers green, the rest with a blackish medial band and broad gray tips; lower tail-coverts cinnamon-coloured (more or less deep) in the male; subdued white, marked with green, in the female. Bill greenish-white, with a large vermilion spot occupying the membrane at the lateral base of the mandibles; legs also vermilion; irides deep red-brown, with a blue inner circle; and orbital skin bright green. Length, $10\frac{3}{4}$ inches by 17 inches; closed wing $5\frac{3}{4}$ in.

This bird inhabits the central and lower hilly regions of Nepal, and more abundantly those of Assam and Arracan, spreading southward to the Tenasserim provinces and Malay peninsula. It also occurs in the hilly districts of Bengal, but rarely strays into the plains, though specimens are occasionally met with even near Calcutta. Mr. Hodgson states, that "it is not very gregarious; adheres to the forests; feeds chiefly on soft fruits; and prefers the trees to the ground, but without absolute exclusiveness of habit in that respect."

Most closely allied and hitherto confounded with it is *Tr. aromatica* of Java, and I believe of the more eastern portion of the Malayan Archipelago generally (the *Col. curvirostris*, and the female, *C. tannensis*, of Gmelin)*. The latter differs by having a bright yellow beak, greenish at sides towards base, and the nude skin at the sides of its base is apparently blue, fading into a blackish tint in the dry specimen; while in *Tr. nipalensis* the vermilion colour fades to amber; the anterior half of the crown is much more albescent; the fulvous tinge on the breast much stronger; the maroon colour of the back is more extended; the

* Mr. G. R. Gray's figures of the beak, &c. of a species of Hurrial to which he applies the name *aromatica*, in his illustrated work on the genera of birds, refer to a species of the following section of this genus.

longest tertiaries are greenish-dusky instead of green; and the lower tail-coverts are of a deeper cinnamon colour. Lastly, the corneous portion of the upper mandible scarcely extends quite so far back as in *Tr. nipalensis*; and a curious and marked distinction consists in the Indian species having the inner web of its third primary sinuated, as in the Hurrials of the next section, while its closely allied Javanese representative exhibits no decided trace of such a character *. In a third species which I refer to this section, the *Tr. Capellei*, Temm.† (common near the Straits of Malacca), the beak is lengthened by the prolongation of its soft and tumid basal portion becoming, as remarked by Mr. Strickland, "almost vulturine in form;" while the size of the bird is considerably larger, and, it may be added, that the sinuation of the interior web of its third primary exists, but not to the same depth as in *Tr. nipalensis*.

B. Typical Treron. Hurrials with the beak moderately robust, much less so than in the preceding section, its corneous portion occupying the terminal half, or thereabouts. There is no bare space round the eyes, and the tail is squared. Sinuation of the third primary well-developed in eight species examined, and probably therefore throughout the group.

Tr. phœnicoptera: *Col. phœnicoptera*, Latham: *C. militaris*, Temm.: *C. Hardwickii*, Gray (figured in Griffith's Animal Kingdom, viii. 299): *Vinago militaris*, Gould's Century, pl. 58 ‡. Green. The neck all round, with the breast, bright yellowish-green, having a shade of fulvous; cap, sides of base of neck, and the abdominal region ash-gray, the belly with generally some admixture of green, more or less developed, and there is a green

* This character of the sinuation of the middle of the inner web of the third primary appears to be variable. I have before me two specimens of what I consider the true *aromatica*, both obtained at Malacca, but the male bird presents no trace of such a sinuation, while in the female it is strongly marked. I think therefore that the supposed distinctness of *nipalensis* and *aromatica* requires further confirmation, the differences in colour being very slight.—H.E.S.

† *Treron magnirostris*, Strickland, Ann. and Mag. Nat. Hist. 1844, p. 116, and doubtless *Vin. giganteus* of Raffles, mentioned in the 'Catalogue of Zoological Specimens' appended to Lady Raffles' 'Life of Sir Stamford Raffles,' p. 674, though not the bird referred to in the note attached, which is probably a *Carpophaga*.

‡ Mr. G. R. Gray identifies this bird with *Col. Sti. Thomæ* of Gmelin, to which name he assigns the precedence; but I decidedly think that he is mistaken in so doing. I perceive also that in Griffith's 'Animal Kingdom,' *Col. Sti. Thomæ* is referred to *militaris* of Temminck; this last-named author having stated that *C. Sti. Thomæ* occurs in India.

[The *Columba Sti. Thomæ* was so named from occurring in the island of St. Thomas, on the west coast of Africa, and is undoubtedly distinct from any Asiatic species. It is probably referable to the female of *T. calvus*, Temm., or of *T. crassirostris*, Fraser.—H.E.S.]

tinge on the forehead; shoulder of the wing lilac in the male, and a trace of the same in the female; greater wing-coverts margined with pale yellow, forming an oblique bar across the wing; terminal two-fifths of the tail ash-gray above, albescent underneath, and its medial portion blackish underneath, and deeply tinged with green above; tibial plumes (extending partly down the tarse) and central abdominal feathers between the tibiæ bright yellow; vent mingled white and green; and lower tail-coverts maroon, with white tips. Beak whitish; the feet deep yellow. Length $12\frac{1}{2}$ by 22 inches, and of closed wing 7 to $7\frac{1}{2}$ inches.

This is one of three closely-allied species, each having its peculiar habitat; and it is intermediate in its colouring to the two others, namely *Tr. viridifrons*, nobis, of the Tenasserim provinces, and *Tr. chlorigaster*, nobis, of Peninsular India. *Tr. viridifrons* is distinguished by having the anterior half of the head and the medial portion of the tail of the same (and as bright) yellowish-green as the breast, though somewhat less fulvescent; that of the tail being *well-defined*, and contrasting strongly both with the gray tip and also with the gray coverts impending the tail, so that this green appears as a very conspicuous broad caudal band: the throat also is not weaker-coloured, as in *Tr. phœnicoptera*. *Tr. chlorigaster*, on the other hand, has the whole under parts green; no trace of green upon the tail, except at its extreme base, and the whole cap and ear-coverts are ashy, devoid (in fine males at least) of the slightest tinge of green on the forehead. These are, in fact, three osculant races, which, if commonly inhabiting the same districts, would doubtless intermix and blend, like *Coracias indica* and *C. affinis*, and likewise certain of the Kalidge pheasants (*Gallophasis*); but within their own proper range of distribution, each continues true to the colouring which distinguishes it from the others. To term them local varieties of the same species, would not merely imply that the three are descended from a common origin, but also that *such* changes of colouring are brought about by difference of locality; a notion which is inconsistent with the fixity and regularity of markings we observe in either race, over an extensive and diversified range of country. *Tr. phœnicoptera* is a very abundant species in Bengal, Assam, Sylhet, Nepal, and all Upper India, its range extending southward at least to the foot of the mountains of Central India, where it would seem to be equally common with the next, and intermediate specimens are met with even in Lower Bengal. In Arracan it does not appear to have been met with, but further southward, in the Tenasserim provinces, it is represented by its other near affine, *Tr. viridifrons**.

* Capt. Hutton writes me word from Mussooree, that *Treron phœnico-*

Tr. chlorigaster, nobis, Journ. As. Soc. 1843, p. 167 : *Tr. Jerdoni,* Strickland, Ann. and Mag. Nat. Hist. 1844, p. 38 : *Vinago phœnicoptera v. militaris* of Southern India, *Auctorum.* Similar to the last, except in the particulars already mentioned. It replaces *Tr. phœnicoptera* in the Peninsula of India, and specimens are occasionally met with in the vicinity of Calcutta. These three species have the feet of a deep yellow colour, whereas in all the other Asiatic Hurrials they would appear to be bright red.

Tr. bicincta : *Vinago bicincta,* Jerdon, Ill. Ind. Orn. pl. 21 ; Madras Journal, 1840, p. 13 (the male) ; and *V. unicolor,* Jerdon, *ibid.* (the female) : *V. vernans,* var. Lesson's Traité. (*Chota Hurrial,* Hind, Bengal.) Green : the forehead and throat brighter and more yellowish, as are the whole under-parts of the female, passing in both sexes to bright pale yellow towards the vent ; occipital region ash-gray ; a stripe of yellow along the wing, formed by the margins of the greater and outer coverts ; tail gray above, with a blackish medial band on all but its middle feathers ; beneath blackish, tipped with grayish-white ; and its lower coverts cinnamon-coloured in the male, and mingled dusky-ash and buffy-whitish in the female. The male is further distinguished by having a large buff-orange patch on the breast, and above this a lilac band, broader at the sides. Bill greenish-glaucous ; and the legs deep pinkish-red. Length 11 or 12 inches by 20, or nearly so ; and of wing generally about 6 inches, rarely as much as 6½.

This beautiful species is common to all India, but would seem to be more numerous in Lower Bengal than in the Peninsula ;

ptera is "common in the Deyrah Doon, but never mounts into the hills, where it is replaced by *Tr. sphenura.* Many of the Doon birds," he adds, "have come to be regarded as hill species, from their commonly occurring in collections made by residents at the different hill stations. Such collectors however entertain one or more *shikarrees,* who start off sometimes to the Doon, sometimes to the interior of the mountains, just as they happen to remember or to want any bright-coloured bird ; and when the collection is brought in, the collector never dreams of asking where the birds were shot, but puts them all down together as 'a collection from the hills.' Nepal being further to the south-east than Mussooree, a greater elevation may be required to produce the same temperature that we have ; so that birds which with us are found *only* in the warm valley of the Doon, may *perhaps* in Nepal rise to a certain elevation on the mountains !" Capt. Tickell adds, that "*T. phœnicoptera* is very common throughout the high stony barren parts of Singhbhoom, and in the Mautbhoom district, confining themselves to the burgoolur and peepul trees. They breed in the thick damp forests to the southward towards Sumbulpoor, during the rains, at which time not a single specimen is to be found in these parts. The Oorias sell numbers of the young ones, which are taken to Calcutta." All that I have seen with the Calcutta dealers were from the neighbourhood, and chiefly adults newly taken with bird-lime.

and it occurs plentifully in Nepal, Assam, Sylhet, Tipperah, Arracan and the Tenasserim provinces. In Bengal, however, it is much less numerous than *Tr. phœnicoptera,* and the flocks of the two species do not commingle. I once found its nest, half-way up a small mahogany tree, in the Calcutta Botanic Garden. The eggs, of a somewhat less lengthened form than in pigeons generally, measured an inch and a quarter in the long diameter. I have also obtained the young, which resemble in colouring the adult female. The voice is much the same as in *Tr. phœnicoptera.*

Mr. G. R. Gray has erroneously identified this bird with *Tr. vernans* (L.), common in the Malay countries. The latter differs in its smaller size, having the wing but $5\frac{1}{2}$ inches; in the male having the entire crown and throat gray, instead of green; in the very much greater development of the lilac colour above the orange of the breast, this enveloping the whole neck, whereas in *Tr. bicincta* it is confined to a band above the breast; and in the tail being gray above, with a blackish *terminal* band, and slight grayish extreme tips to the feathers; whereas *Tr. bicincta* has a broad whitish terminal band to the tail, as seen underneath, and which appears of a dull ash-colour above. No two species can be more obviously distinct*.

TR. MALABARICA: *Vinago malabarica,* Jerdon, Ill. Ind. Orn. (Art. *V. bicincta*) : *V. aromatica,* apud Jerdon, Catal. (the male); and *V. affinis,* Jerdon, *ibid.* (the female): also *V. aromatica* of Southern India, Jardine's Nat. Libr., *Columbidæ.* This bird exactly resembles *Tr. nipalensis* in size and colouring, except in having a yellower throat in both sexes; but is at once distinguished by the very different form of its beak, and by having no naked space round the eyes; the buff tinge on the breast of the male is also more decided, and its legs are 'lake-red.' The female may be distinguished from that of *Tr. bicincta* by the ash-colour of its forehead and entire crown, and by its unspread tail being wholly green above.

Mr. Jerdon's specimens of this bird were obtained on the western coast of the Peninsula, and at the foot of the Neilgherries. I have never seen it from Northern India; but to the eastward it inhabits Assam†, Sylhet, Tipperah, and appears to be equally common with *Tr. nipalensis* in the island of Ramree, Arracan.

* I killed a specimen of *Tr. bicincta* some years ago in Singhbhoom, when firing into a flock of the common Hurrial; and I have more than once remarked in a flock of the latter, smaller individuals, which I have no doubt were interlopers of this species. It is exceedingly rare here, for I have never obtained another specimen.—T.

† It is figured among Dr. McClelland's drawings of the birds of Assam.

There is a nearly allied species in the Nicobar islands, *Tr. chloroptera*, nobis, which differs in its superior size, having the wing 7 inches, instead of 6 to $6\frac{1}{4}$; and in the male having a large portion of the fore part of its wing green instead of deep maroon; its breast also is less tinged with fulvous, and the forehead more albescent.

Columba pompadora, Gmelin, founded on pl. 19 and 20 of Brown's Zoology (1776), should be another nearly allied species, inhabiting Ceylon; but as both figure and description represent the back to be green instead of maroon, like the rest of the mantle, and as it is also described as "smaller than the turtle-dove," it clearly cannot be *Tr. malabarica*, and is probably a sort of representative (as regards its diminutive size) of *Tr. olax* of the Malay countries*.

C. Sphenurus, Swainson: *Sphenocercus*, G. R. Gray. Hurrials with cuneiform tail, of which the central feathers are, in some species, much elongated beyond the rest, and their prolonged tips attenuated, with the basal two-thirds or more of the bill soft and tumid, and with the soles of the toes narrow, whereas in the preceding sections they are particularly broad and flat: a nude livid space surrounds the eyes, but less developed than in the first section; and the curious character observable throughout the preceding group, of having the inner web of the third primary abruptly sinuated, does not exist in the present one. These birds are exclusively mountaineers, inhabiting the hill-forests, and are remarkable for the music of their notes.

Tr. sphenura: *Vinago sphenura*, Vigors, Proc. Zool. Soc. 1831, p. 173; Gould's Century, pl. 57: *Kokla* or *Kokhela*, H. (a name also applied to the next species). Very similar in colouring to *Tr. nipalensis* and *Tr. malabarica*, but larger, and at once distinguished by its cuneiform tail; by the greater development of the soft basal portion of its bill; also by the green colour tinged in the male with buff of its crown; by the considerable diminution of the maroon colour on the mantle of the male, especially on the back, the posterior scapularies, the tertiaries, and the great wing-coverts being green; and by having but a slight pale yellow margin to only the great coverts of the wing. Tail green above, with an ill-defined subterminal dusky band to its outer feathers, and uniform dull albescent-gray underneath; its lower coverts long, and of a pale rufous-buff hue in the male, yellowish white with green centres in the female, as are likewise the short outer ones of the male; breast of the latter deeply tinged with buff. In the female, the subterminal dusky band on

* I have no doubt of the identity of *pompadora* and *malabarica*. Brown's description is drawn up from the sketch of a native artist, and great accuracy cannot therefore be expected.—H.E.S.

the three outer tail-feathers is much better defined. Irides coloured as usual; the bill, and nude skin around the eye, livid, and legs coral-red. Wing 7 to $7\frac{1}{4}$ inches; middle tail-feathers $5\frac{3}{4}$ inches.

This species inhabits the Himalaya, and is, I believe, more abundant in the south-eastern portion of the chain, as in Nepal and at Darjeeling, though it is also common at Simla. Capt. Hutton writes from Mussoorie—"This species is very numerous in the hills from April to June, when, having reared its young, and the rains having set in, it becomes scarcer, and gradually disappears during the rainy season. The nest is in high trees, composed of dried twigs, a mere platform; and the eggs are two, and white. I heard the first *Kooklah* this year on the 12th of April." It is greatly prized by the natives as a cage-bird, on account of its singularly prolonged and varied musical note, which is an improvement upon that of *Tr. phœnicoptera* and its allies. A few are even brought in cages to Calcutta, and sell at a high price as song-birds. I have heard the notes of both this and the next species, which I think are absolutely similar: they bear some resemblance to the human voice in singing, and are highly musical in tone, being considerably prolonged and modulated, but always terminating abruptly; and every time the stave is repeated exactly as before, so that it soon becomes wearisome to an European ear *.

TR. CANTILLANS: *Vinago cantillans*, nobis, Journ. As. Soc. xii. 166: *Col. aromatica*, var. A, Latham. Size and proportions of last, but the green colour replaced by a delicate pearl-gray, with a slight tinge of green here and there, more especially on the under-parts: forehead and throat whitish; the crown and breast of the male tinged with ruddy or weak maroon; and the mantle marked, as in *Tr. sphenura*, with deeper maroon: a slight yellowish-white outer edging to the greater wing-coverts. Irides as usual in this genus, or having a crimson ring encircling a violet one: bill and bare skin around the eye glaucous-blue,

* *Tr. sphenurus.* This bird, the *Kookoo-fo* of the Lepchas at Darjeeling, is there exceedingly common, but is not so extensively gregarious as the common Hurrial of the plains. They frequent the highest trees, feeding on their berries, and running along the branches with great agility. The male has a most agreeable note, exactly resembling the music of a pastoral reed or pipe. It breeds in June and July, making a large nest in high trees, deeper than that of the common doves and wood pigeons. Bill pale livid blue, nearly white at tip, and pale clear cobalt basally. The young resemble the female; and the ruddy tinge of the back and small wing-coverts of the male is not assumed until the second year.—T.

I have observed this red to be less developed in some specimens, but still suspect that more or less of it would be obtained at the first moult.—E.B.

and legs and toes reddish-carneous. The female I have not yet seen. Length 13 by 21 inches; closed wing 7 inches.

This species occurs in the north-west Himalaya, as about Simla, and is, I believe, rare in Nepal. I kept one alive for some time that was stated to have been brought from Agra, whither it had no doubt been carried from the hills. Can it be a variety only of the last?

Tr. apicauda, Hodgson (mentioned in Mr. G. R. Gray's Catalogue of the Ornithological Specimens in the British Museum). Nearly allied to *Tr. oxyura* of the Malay countries, from which it is at once distinguished by the pale yellow margins of its great wing-coverts, forming two narrow longitudinally oblique bars on the wing. General colour green, more yellowish towards the tail and on the under-parts, and tinged in the male with russet on the crown and breast; primaries dusky black; tail with its middle feathers greatly prolonged beyond the rest, and their elongated portion much attenuated; its colour gray with a medial blackish band, obsolete on the middle pair of feathers, which at base are yellowish-green. Bill evidently glaucous-bluish, and legs red. Length of wing 6½ inches, and of middle tail-feathers 8 inches or more, passing the next pair by about 3 inches.

Inhabits the south-eastern Himalaya and the hill-ranges of Assam, being tolerably common at Darjeeling.

Genus Carpophaga, Selby (1835): *Ducula*, Hodgson (1836): *Dukul*, or *Dunkul*, H. The Dunkuls.

These fruit pigeons are mostly of large size, with broad-soled feet and strong hooked claws, much as in the typical Hurrials, and a slender, generally somewhat lengthened bill, having the terminal third only of its upper mandible corneous, and the plumage of the chin advancing very far forward, underneath the lower mandible. In a few species the base of the upper mandible expands to form a fleshy knob. Wings, in all the typical species, adapted for powerful flight. The plumage of the head, neck and under-parts, and in some species throughout, is blent and glossless, and mostly of a delicate gray, or a vinous hue, with never the peculiar burnish on the sides of the neck so general among ordinary pigeons; but many species have the upper parts, wings and tail shining metallic green, which in some is bronzed or coppery, in others varied with rich steel-blue; hence several are among the most showy of the pigeon tribe; others, however, being simply black and white, though all are alike handsome when viewed in the fresh state, from the delicate beauty of the irides, bill, feet, and any nude skin about the head, the exquisite colouring of which is lost in the dry specimen. These birds are more especially developed in the great Oriental Archipelago, where

the species are very numerous, two only occurring in India, and others in Australia and Polynesia. They are gregarious, like the Hurrials, and keep exclusively to the great forests, more especially to those of upland districts: and it would appear that they do not generally lay more than a single egg, and certain species invariably but one; in which respect they resemble the celebrated Passenger Pigeon of North America (*Ectopistes migratoria*). At least three subgenera occur, at the head of which may be placed *Lopholaimus*, G. R. Gray, founded on the *Col. antarctica*, Shaw (v. *dilopha*, Temm.), of Australia; then follow the ordinary Dunkuls, of which the two Indian species are characteristic; and finally a short-winged type, with bill and feet as in the former, and colouring as in the division *Chalcophaps* (of the next subfamily), to which I apply the appellation *Dendrophaps*.

C. INSIGNIS: *Ducula insignis*, Hodgson, As. Res. xix. 162: *Carp. cuprea*, Jerdon, Madr. Journ. 1840, p. 12, and subsequently referred by him to *Col. badia*, Raffles, *ibid.* 1844, p. 164. (*Dukul*, Nepal; *Dunkul*, H.) Head, neck and under-parts pale ruddy lilac-gray; the throat albescent; and crown pure cinereous in some specimens, in others tinged with ruddy; back and wings deep vinaceous-brown; the rump and upper tail-coverts dusky-cinereous, and the lower tail-coverts buffy-white; tail dusky, with its terminal fourth dull ashy above, and albescent as seen from beneath. Bill, circle of eyelids and legs intense sanguine, except the tip of the bill and the claws, which are horn-coloured; orbital skin livid; and irides "hoary or blue-gray," according to Mr. Hodgson, "red," as stated by Mr. Jerdon. Length 20 inches by 2½ feet (Hodgson), 19 by 26 inches (Jerdon); of wing 9½ inches, and of tail 8 inches. Weight a pound and a half. "The female," remarks Mr. Hodgson, "is a fourth smaller than her mate, wants almost wholly the rich vinous tint of the male, and is generally more obscurely coloured."

This diversity of colouring of the sexes reminds us of the Hurrials; and it may be remarked, that the general tints are not very different from those of *Treron cantillans*. The species inhabits the Himalaya and the Neilgherries; and Captain Phayre has obtained it in the Ya-ma-dong mountains, which separate Arracan from Pegu. It appears to keep always to a more elevated region than the next species, as near the snow line of the Himalaya; and Mr. Hodgson states that it is "almost solitary" in its habits*.

* *Carpophaga insignis*. Of this fine species I killed a female (one of a pair, the male of which escaped) at Kursiong, towards the end of the month of June. It is not common. The pair were perched on a small tree on the summit of the hill, feeding on berries, with which the crop of the

The *Col. badia,* Raffles (v. *capistrata,* Temm.), of the Malay countries, would appear to be very closely allied in its colouring, but considerably inferior in size; the two are regarded as distinct by Mr. G. R. Gray.

C. SYLVATICA: *Col. sylvatica,* Tickell, Journ. As. Soc. ii. 581: *C. ænea* of India, *Auctorum;* but not of Raffles, Linn. Trans. xiii. 316. (*Dunkul,* H.; *Pyoon-ma-dee,* Arracan.) Head, neck and under-parts pearl-gray, purer on the crown and breast, and tinged elsewhere (and occasionally on the crown) with ruddy-vinaceous; back, wings, rump and tail shining coppery-green, with a dash of gray on the large alars, and greenest upon the tail; under tail-coverts dark maroon; chin and immediately around the base of the bill white. "Irides and orbits lake-red; bill slaty, at base above red, at tip bluish-white; legs lake-red," (Jerdon). Another observer describes the irides to be "deep pink;" but Captain Tickell writes: "Eyes orange; feet rose-coloured; bill horny, bluish over the nostrils." Length 18 or 19 inches; expanse 2½ feet; closed wing 9 inches to 9½, and tail 6 inches to 6½; sexes alike.

"This fine species," remarks Mr. Jerdon, "is found in all the lofty forests of the west coast, single, or in small parties of three or four. It has a single, low, plaintive note." Captain Tickell, in his 'List of Birds collected in the Jungles of Borabhúm and Dholbhúm,' states that it is "common in some parts, preferring the open and large-timbered tracts. They are wild and difficult of approach, and go generally in small parties of four or five. The voice is deep, and resembles groaning." I have never seen it from the Himalaya, but it is very abundant in the hill regions of Assam, Sylhet, Tipperah, and Arracan; also in the Tenasserim provinces; and the Asiatic Society has received it from Java. A writer in the 'Bengal Sporting Review' (no. 2. p. 89) observes, "The habits of this handsome bird are strictly arboreal; it is seldom seen but in the depths of the jungle; is gregarious, like the Hurrials, but is only a cold-weather resident in the eastern districts of Bengal, and breeds elsewhere*. It makes its appearance in November, and leaves towards the end of March. Its favourite food consists of the bijer plum (*Zizyphus Jujuba*), and a jungle berry, called by the natives *Anygootah.* When wounded it evinces more spirit than the *Columbidæ* appear generally to possess; erecting the feathers of its head and neck, and

female was filled. Voice a deep short groan, repeated—'*woo-woo-woo.*' Length of this female 17 inches by 27 inches in spread of wing; wing 9 inches. Irides pearl-gray; bill dull lake, with blackish tip; legs dull lake. Back, scapularies and wing-coverts full deep vinous ash-gray washed with cupreous, the latter pervading the tips and edges of the feathers.—T.

* Mr. Frith found a nest of this bird in the Garrow hills.

buffeting with its wings the hand that captures it. The note is harsh, not unlike the croaking of a bull-frog *."

There are several closely allied species: *C. ænea*, as figured (*i. e.* the head) by Mr. G. R. Gray in his illustrated work on the 'Genera of Birds,' has a large round knob at the base of its upper mandible, of which the Indian species never presents the slightest trace; and a beautiful specimen before me, from Borneo (?), exhibiting this knob, differs also from the Indian species in several other particulars †. Another, from the same region, exactly resembles the Indian species, except in its inferior size, having the wing but 8 inches, and the rest in proportion; this is doubtless the *C. ænea* of Raffles's list, described as "exceeding 15 inches in length"; so that in Sumatra there would appear to be closely allied diminutives of both the Indian species ‡. *C. perspicillata* of Java and the Moluccas also approximates a good deal, but is readily enough distinguishable.

Of the third great genus of fruit-eating pigeons, *Ptilinopus*, also largely developed in the Eastern Archipelago and Polynesian isles, no Indian species has been discovered; the *Pt. Elphinstonii* of Sykes (seemingly) appertaining to the same group of ordinary pigeons as the British Cushat or Ring-dove.

[To be continued.]

BIBLIOGRAPHICAL NOTICES.

A Natural History of the Mammalia. By G. R. Waterhouse, Esq., of the British Museum. Illustrated with engravings on wood and coloured plates. London, H. Baillière.

The first volume of this excellent work, in which every species in the class Mammalia will be described in detail, is now completed. The author is already favourably known to the public by various monographs, and by papers in this Journal, on the Rodentia, Marsupiata and other animals. His former connexion with the Zoological Society and his present position in the British Museum (where he is

* *C. sylvatica.* I have found these birds only in one part of my district,—in the jungles bordering on Midnapore. They were in a party of eight or ten, perching on detached trees, in a wide plain of jungle-grass. The notes are deep and ventriloquous. By the Oorias it is called *Sona Kubootra*, or Golden Pigeon; it is also termed *Burra* (or Great) *Hurrial.*—T.

† It seems to be the "Sumatran Pigeon, no. 12," of Latham.

‡ The true *Columba ænea* of Linnæus is founded on the *Palumbus moluccensis* of Brisson, whose figure and description perfectly accord with the Indian bird, though it is stated to be from the Moluccas. The knob-fronted species will stand as *C. myristicivora*, Scop. (*C. globicera*, Wagl.), founded on Sonn. Voy. Nouv. Guinée, pl. 102. Mr. Gray erroneously applies the name *myristicivora* to Sonn. pl. 103, which is the *bicolor* of Scopoli.—H.E.S.

at present chiefly employed on fossil Mammalia),—his extensive acquaintance with the works of foreign naturalists, as shown by the numerous references in this publication,—together with several visits undertaken solely from his love of science to the museums on the continent, eminently fit him for the great work here commenced. We use this expression advisedly, for it must not be supposed that we have here merely a compilation; original descriptions, and measurements generally taken from more than one specimen, are in the majority of cases given. The dental and osteological details are described with particular care, and are illustrated by distinct and careful plates: in the precision of these details, we imagine we see the effects of Mr. Waterhouse's long and ardent attachment to entomology. Although the work is not a compilation, the author has not neglected any source of information; and in this first volume, which is confined to the Marsupiata, he is much indebted to Mr. Gould's admirable labours in Australia. Mr. Waterhouse however often differs from Mr. Gould with respect to specific characters, and we rejoice to see no signs of that rage to create new species, so prevalent amongst zoologists.

A distinguishing feature in this work is the notice of all fossil species, interpolated in their proper places; hence, when the whole is completed, we shall have a comprehensive view of the entire class of Mammalia, as far as known; and the accident of extinction will not remove from the series, as is too often the case in systematic works, allied or intermediate forms. Many curious and original remarks are interspersed on the affinities of the various genera and families; but we find no trace of those fanciful speculations on analogies—such as between a mouse's nose and a snipe's beak, or between oxen and poultry—which we fear must have lowered us in the estimation of continental naturalists. In reference to affinities, we must express our regret that the Marsupiata were not ranked, in conformity with Prof. Owen's views, as a sub-class distinct from the placental mammifers. Whether we view classification as a mere contrivance to convey much information by a single word, or as something more than a *memoria technica*, and as connected with the laws of creation, we cannot doubt that where such important differences in the generative and cerebral systems, as distinguish the Marsupiata from the Placentata, run through two series of animals, they ought to be arranged under heads of equal value. We are not convinced by the ingenious remarks on this subject given at p. 17; we cannot admit that numerical differences in the number of the species in two groups, or their geographical distribution, or a somewhat hypothetical statement that the amount of difference is greatest amongst the lower forms in each class, ought to be taken into account in a system of classification; we believe that our best botanists, who may well serve as guides on this subject, eschew such considerations, and confine themselves to the strict rule of difference in structure. Should this rule be disregarded, some naturalists would admit habits (useful as they undoubtedly are)—some would admit analogies, or, as well expressed by Lamarck, adaptations in widely different

beings to similar external conditions,—some would admit the supposed order of the appearance of organic beings (as has been suggested) on the surface of the earth, as aids or bases of classification; —the result would be, that no two naturalists would agree in the same conclusion, and our system, instead of becoming a solid and simple edifice, would be a labyrinth of blind passages.

An admirable feature in Mr. Waterhouse's work is the great attention paid to Geographical distribution, that noble subject of which we as yet but dimly see the full bearing. The following remarks (p. 537) give us an excellent summary on the distribution of the Mammalia on the Australian continent:—

"Australia may be conveniently divided into five principal divisions or districts, of which the east, west, north and south portions of the main land will each form one province, and Van Diemen's Land the fifth. Of these provinces, the northern one has the greatest number of species peculiar to it, since out of ten species discovered in that part of Australia, eight are not found elsewhere. The Marsupiata of the eastern district are for the most part distinct from those of the opposite side of the continent, there being but eight species, out of upwards of sixty inhabiting the two provinces, which are found in both. But if the three districts mentioned are characterized by the few species which they have in common, South Australia must be characterized by an opposite quality, that of having a comparatively large proportion of species identical with those of other districts; indeed I know of but four species which are peculiar to this district: it possesses sixteen species in common with Western Australia, and fifteen in common with Eastern Australia. Western Australia possesses one genus (*Tarsipes*) which is peculiar to it, and one sub-genus (*Macrotis*); none of the other districts of continental Australia possess any genera which are not found elsewhere. About half of the species found in Van Diemen's Land are peculiar to that island—in fact, nine out of twenty: of the remainder, the greater portion are found on the eastern part of the main land. This island, moreover, possesses one genus (*Thylacinus*) and one sub-genus (*Sarcophilus*) which are now peculiar to it. Examples of both these sections have, however, been found in a fossil state on the main land."

Speaking strictly we have here four divisions, for South Australia does not appear from these remarks, zoologically considered, to deserve to be ranked as a subdivision. New Guinea, however, and the adjacent islands form a well-marked fifth subdivision, and an interesting table is given (at p. 3) of the ranges of the quadrupeds inhabiting them. The fact of South Australia possessing only few peculiar species, it having apparently been colonized from the eastern and western coasts, is very interesting; for we believe that Mr. Robert Brown has shown that nearly the same remark is applicable to the plants; and Mr. Gould finds that most of the birds from these opposite shores, though closely allied, are distinct. Considering these facts, together with the presence in South Australia of upraised modern tertiary deposits and of extinct volcanos, it seems

probable that the eastern and western shores once formed two islands, separated from each other by a shallow sea, with their inhabitants generically though not specifically related, exactly as are those of New Guinea and Northern Australia, and that within a geologically recent period a series of upheavals converted the intermediate sea into those desert plains which are now known to stretch from the southern coast far northward, and which then became colonized from the regions to the east and west. We will only further point out an interesting table (p. 536) showing that in South America, Brazil is the metropolis of the Didelphidæ, a family which, as Mr. Waterhouse remarks, curiously replaces in that continent the Insectivora of the Old World.

Most of the genera are illustrated by elegant and spirited copperplates; there are also many woodcuts; some few however of these latter are rather unfortunate works of art. The plates are printed on excellent paper, and the whole work is got up in a style creditable to the publisher. The Marsupiata, though highly interesting in their structure and affinities, yet are less so in their habits than the higher mammalia; but from some scattered notices we clearly see that this amusing part of the subject will not be neglected. To the professed naturalist we believe that this work will be almost indispensable; but we also strongly recommend it to those who do not come under this class, but yet are interested in the wide field of nature. We do not doubt that Mr. Waterhouse is conferring by this publication a real service on natural science; we therefore trust to his continued perseverance, and we heartily wish him all success.

Introduction to Zoology: for the Use of Schools. By Robert Patterson, Vice-President of the Natural History Society of Belfast. —*Invertebrate Animals.* With upwards of 170 Illustrations. London: Simpkin and Co. 1846.

The main cause of the great ignorance of Natural History in this country among all classes, not excluding even the highest, is that it forms no part of our regular system of education. Most of our youth leave school scarcely aware of the existence of such a science, and so utterly unacquainted with its merest rudiments, that to be told that whales and bats give suck to their young, would excite in them a contemptuous smile of incredulity. This is deplorable; but it is the misfortune not the fault of our youth, that they are thus ignorant of facts with which mere children in France and Germany are familiar. Fully occupied with the routine of our usual instruction at school, and thence directly transferred either to college or the active duties of commercial or professional life, they have no opportunity of repairing this great deficiency of their early education, and thus remain deprived of what may be justly called another sense—the power of seeing at every step objects of the highest interest and delight, to which the man unacquainted with natural history is blind, and of thus opening to themselves a new source of mental enjoyment, which, whether they traverse the mighty ocean

or the pathless desert, stroll through the woods or the fields, or are even confined to the limits of a garden, will be found to be endless and inexhaustible.

It is the conviction of this great defect in our system of education which has led Mr. Patterson, Vice-President of the Natural History Society of Belfast, and well-known as an excellent observer of nature, to compose the work whose title stands at the head of this notice, which from his intimate acquaintance with the subject, the popular interest he has imparted to it, and the numerous excellent wood-cuts (chiefly adapted from Milne Edwards's 'Cours Elémentaire de Zoologie') amply illustrating every part of it, combined with its low price, may be regarded as one of the most valuable contributions ever offered towards the more extended cultivation of natural history in this country.

As its high character as an elementary work has been recognised by the Board of National Education in Ireland, by its adoption in all the National Schools there (of which in December 1845 the number was 3426, attended by 432,844 scholars), it is superfluous to speak further in its praise, and we shall merely state our full persuasion, that if adopted, as we trust it will be, in all our schools, both for the upper and lower classes, the next generation will show a hundred naturalists for one that we can now boast of, and that results, the value and importance of which can scarcely be too highly estimated, will attend a more extended cultivation of a science, which, as Mr. Patterson truly observes in his preface, "exercises both the observant and reflective powers, furnishes enjoyment pure and exhaustless, and tends to make devotional feelings habitual."

We conclude with the following anecdote from the Work, both as a specimen of its popular manner, and as proving very strikingly how important an acquaintance with the nature of the lower objects of creation in quarters seemingly the most remote from being affected by them, may often prove. "With regard to the *Medusæ*, we may mention an anecdote which we learned from an eminent zoologist, now a professor in one of the English Universities. He had a few years ago been delivering some zoological lectures in a seaport town in Scotland, in the course of which he had adverted to some of the most remarkable points in the economy of the *Acalephæ*. After the lecture, a farmer who had been present came forward, and inquired if he had understood him correctly, as having stated that the *Medusæ* contained so little of solid material, that they might be regarded as little else than a mass of animated sea-water? On being answered in the affirmative, he remarked that it would have saved him many a pound had he known that sooner, for he had been in the habit of employing his men and horses in carting away large quantities of jelly-fish from the shores and using them as manure on his farm, and he now believed they could have been of little more real use than an equal weight of sea-water. Assuming that as much as one ton weight of *Medusæ* recently thrown on the beach had been carted away in one load, it will be found that, according to the experiments of Prof. Owen already mentioned (p. 30), the entire quantity of solid

material would be only about four pounds, an amount, which, if compressed, the farmer might with ease have carried home in one of his coat-pockets!"—P. 39.

ELIÆ FRIES *Summa Vegetabilium Scandinaviæ.* Holmiæ et Lipsiæ.

A new work by Prof. Fries of Upsala—need we say more in its recommendation? It may however be as well to mention the character of its contents.

It has long been known that Fries was contemplating a Flora of Scandinavia, i.e., as he defines it, "inter mare occidentale et album, inter Eidoram et Nordkap." The present may be considered as the forerunner of such a work, since it contains a complete catalogue of Scandinavian plants accompanied by a tabular view of their distribution. This is followed by a synopsis of such species as are either not contained in the invaluable 'Synopsis Floræ Germanicæ' of Koch, or are considered by Fries to require further elucidation or correction. In short it may be considered, as observed by its author, to be an extension of the 'Synopsis Floræ Germanicæ,' which is bounded on the north by the Baltic Sea and the river Eyder, from that river, through Denmark, Sweden, Finland, Lapland and Norway, to the North Cape. It is therefore essential to all who make use (and what botanist does not?) of Koch's Synopsis.

PROCEEDINGS OF LEARNED SOCIETIES.

ENTOMOLOGICAL SOCIETY.

[Continued from vol. xviii. p. 473.]

September 1st, 1845.—The Rev. F. W. Hope, President, in the Chair.

"Further notes on the Honey-bee." By Mr. Golding and Dr. Bevan.

In this communication Mr. Golding again affirmed that the first swarm from a hive is led off by the queen-bee. He considered that it was chiefly owing to the striking peculiarity in the royal cells that the insects developed therein are so different from the ordinary individuals in the hive. He adopts the opinion of Hüber, that the great number of males in a hive is rendered necessary in order to ensure the fecundation of the virgin queen in her flight in the air, and that the law of primogeniture seems to be followed strictly in the emigration of young queens. From the fact that the long piping note of a young queen at liberty may be heard—but with short intervals of a minute or two—without intermission, from the time of her hatching until she comes off with the swarm, together with their having been seen to leave the hive in a day or two after being hived, he thinks it may be safely inferred that impregnation in the case of the young emigrant queen takes place after she becomes sovereign in her own right, and that she never leaves the hive until accompanying the swarm.

Dr. Bevan's communication was a reply to a note addressed to him by Mr. Westwood, and is as follows:—

"Machynlleth, August 25, 1845.

"My dear Sir,—I was well pleased to find from your favour of the 12th inst. that our opinions on the relative perfection of queen- and worker-bees were in unison; and also to learn, from your letter to Mr. Golding, that we agree as to the probable effect of the pabulum which is supplied, as well to the development of animal as of vegetable life. The instance which you refer to of the effect produced on flowers by the soil in which they bloom, and of course by the kind of nutriment which the plants derive therefrom, is very much in point. So likewise is its effect on fruit. It is well-known that in the cider counties the juice of the same fruit, treated in the same manner, will produce very different sorts of cider, according to the soil by which the trees are nourished. In Herefordshire to wit, the clay side of the county affords a sweet pleasant liquor, the sandy side a liquor that is rough and harsh, the fruit being the same. The mere dimensions of the royal cell without other concomitants would, I conceive, only cause the evolution of a large worker-bee, not a bee undergoing such wonderful changes as a queen presents, and capable of continuing its race. To accomplish this end, supported as we are by various analogies, it is surely reasonable to believe that much, if not the whole, depends upon diet. With yourself, I should much like to obtain the analogies of other swarming insects, such as humble-bees, wasps, ants, &c., in support or otherwise of this theory, but must transfer the research to the eyes of younger investigators and the resources of another Hüber.

"As I now, for the first time, learn what was stated in the British Association * at Cambridge, and am unacquainted with the particulars, which ought to be minutely ascertained before an opinion resting on such abundant evidence can be shaken, that matter must stand over for the present. I should like to know what evidence can be afforded that the queen which accompanied the swarm *was* a young one; also, whether it be clearly ascertained to have been a first swarm, and what queen, if any, was left behind. The hive might have contained a superannuated queen, which died during the maturation of her successor, though in that case I should conceive that the family would not have been populous enough to send forth a swarm. But she might have issued unknown to her proprietor, and have lost her life from some accident prior to being hived, in which case the swarm might return, and might in a short time afterwards re-issue with a young queen. Upon one or other of these suppositions only can I ever believe a prime swarm would be accompanied by a young queen.

"The disproportionate number of males usually found in a family of bees, in summer, has long been a stumbling-block with naturalists; but it is a difficulty which Hüber hoped he had been able to

* It was stated by one of the members of the British Association, at the meeting at Cambridge, that he had observed a first swarm led off by a newly-hatched queen.—J. O. W.

remove, by what however can only be regarded as an ingenious hypothesis, viz. that as the queen is evidently impregnated in the wide expanse of the atmosphere, this may render a numerous race of males desirable, that she may run no risk of experiencing disappointment in meeting with them. This aërial flight, having impregnation for its object, is countenanced by a similar proceeding among ants and humble-bees. In a correspondence which Feburier held with Mr. Knight, he mentioned a circumstance which fell under his own observation, tending to show that the union of the sexes in bees takes place after the manner of whales and human beings. If so, the horny prehensile appendages which appertain to the genital organs of wasps and hornets would not be needed. The evidence afforded by Mr. Golding of the act having been performed, taken *per se*, is certainly merely presumptive; but confirmed as it is by Hüber's declaration, that a portion of the drone's organ (*corps lenticulaire*) was repeatedly seen by Burnens in the vulva of the young queens, I think Mr. Golding's observation carries weight with it. I never knew nor heard of a princess having been impregnated prior to her quitting the parent hive. The experience of Hüber, Mr. Golding, myself and other apiarians shows that impregnation never takes place till after she has been established in her new abode. In all probability, if she quitted the old stock to take her aërial flight, the next in succession would be set at liberty during her absence, and when she returned, be prepared to receive her in hostile array, an event which the bees appear, on all occasions, sedulously to guard against.

"As regards the law of primogeniture in the royal brood, I think you will be satisfied that it is observed, when you consider the natural enmity which the royal insects bear towards each other; so great as to render it intolerable for more than one to be at liberty in the hive at the same time. The first-born pipes in a shrill tone, her voice being heard through no other medium than that of the air and the hive, while the next in succession, and sometimes even the next but one, sends forth a hoarse note, being heard through the additional medium of the royal cell. And the workers allow not one of the imprisoned princesses to emerge till the swarm issues forth, or till it is decided that there shall be no farther issue; in which latter case the royal cells are left unguarded, and the senior princess is allowed to despatch all the embryo princesses, which she very soon accomplishes, and thereby prevents the possibility of any competition for the throne.—E. Bevan."

A discussion also took place on the potato-disease, the President attributing it chiefly to the attacks of the wire-worm, whilst Mr. Spence and others referred it to atmospheric causes.

October 6th.—The Rev. F. W. Hope, President, in the Chair.

The President exhibited a large collection of *Ichneumonidæ*, recently captured by himself at Southend. Also some plates of exotic *Lepidoptera*, drawn by Mr. Spry for the Transactions, containing

figures of new species of *Charaxes* from his own collection. Likewise a number of specimens of *Scolopendræ* of small size, which he had found in myriads infesting diseased potatoes at Southend, which he was thence induced to consider as the chief cause of the evil; an opinion which was however opposed by several of the members, Mr. Edward Doubleday detailing the results of microscopical observations made in this country and abroad, proving the growth of a minute parasitical fungus within the diseased part of the tubers.

Captain Parry exhibited two cases of insects from Caffraria, including *Manticora latipennis*, Waterh., and other new and rare *Coleoptera*.

Mr. W. W. Saunders exhibited a box of exotic insects, including a new and most brilliant species of *Morpho*, from South America, several species of *Thynnidæ* taken *in copulâ*, and several species of *Zeuzeræ* and other case-making *Lepidoptera* from New Holland.

Mr. Evans exhibited a specimen of *Sphinx Atropos*, taken on the rigging of a ship forty miles from land, off Cape Clear island, and one of *Porthesia auriflua*, taken 250 miles from land in the Bay of Biscay.

Mr. F. Smith exhibited specimens of *Nomada pucata*, one of which was gynandromorphous.

Mr. Edward Doubleday stated that the British Museum had recently acquired a collection of *Lepidoptera* from the north of Bengal, containing a new species of *Papilio* and many other new species, and that a collection from Honduras, formed by Mr. Dyson, had also been recently received by the Museum.

The following memoirs were read:—

The continuation of Mr. Saunders's Descriptions of New Holland *Cryptocephalidæ*.

Sp. 4. Pleomorpha concolor, W.W.S. *Entirely dark blue green, except underside of* 1*st joint of antennæ, which is rufous; elytra shining punctate-striate, the lateral striæ more deeply.* Length $\frac{12}{100}$ths of an inch.—Inhabits Australia. In Mus. Parry.

Sp. 5. Pleomorpha atra, W.W.S. *Entirely black, except underside of first two joints of the antennæ, which is rufous, and the club, which is pitchy brown; mandibles strongly projecting; elytra punctate-striate.* Length $\frac{15}{100}$ths of an inch.—Inhabits Western Australia. In Mus. Hope.

A letter from John Hogg, Esq., F.L.S., addressed to Mr. Westwood, on the alleged habits of *Crabro cephalotes*, dated Norton, July 19, 1845:—

"On my return home on the 28th of June, I observed a couple of the handsome *Crabro cephalotes* about my hot-house, and I found that they had nearly constructed a somewhat curious nest, or deposit for their eggs. It is composed of fine gravel or sand, strongly agglutinated together with clay, and contains four cylindrical cells, which are quite closed up at the top. I watched one of the insects sitting, most likely the *female* depositing her eggs, in the last cell,

which she afterwards finished; and which she has now deserted, as I have not seen her for many days.

"The nest is *firmly* fixed on the lime and gravel surface of the wall of the hot-house, and is itself nearly of an *equal hardness* with it. I do not doubt but each cell contains one or more eggs, and from which in due time young insects will come forth.

"The genus *Crabro* of Fabricius is a part of Linnæus's genus *Sphex*; and I find that the latter author has given a short account of the mode adopted by the *Sphex sabulosa* (now called *Ammophila sabulosa*), of making its hole in the sand, and of depositing its eggs in the bodies of insects (see Syst. Nat., edit. 12, p. 941, vol. ii.); and he also describes (p. 942) how the *Sphex figulus* makes its nest in holes in wood, and 'nidum *argillâ claudit*.' The mode there described of that insect using *clay* is similar to that adopted by the *Crabro cephalotes*, but I did not notice it conveying a spider, or the larva of any other insect, into its nest; though perhaps, if the cells were examined, some such insect might be discovered within them.

"A few days ago I observed some sparrows on their nest in a tree in my garden pulling about something which appeared like a bundle of white feathers; a short time afterwards I went to water some flowers below the same tree, when to my surprise I found on the ground a beautiful nest of the *Vespa Britannica*. The sparrows having however dug holes with their bills in the lower portion of it, in search of larvæ, or of something to devour, had a good deal injured this most elegantly-made nest."

In a subsequent communication Mr. Hogg states that he is quite certain the insect which formed the nest "is the *same* as that which I sent to you some few years ago, and which *you named* 'Crabro cephalotes'; and the reason of my troubling you with my communication was, that I strongly suspected that its economy in *nidification* has never been fully ascertained. But as I before said, I have not at hand Shuckard's 'Monograph of the Fossorial Hymenoptera,' or any other modern work which describes the species. That it may sometimes make its nest in the holes of rotten wood or in sand-banks, I do not know; but that it does *not always* do so, the present example clearly proves.

"One of the insects (probably the *male*) I only saw one day; it was *inside*, flying up and down the glass light of the hot-house. The other, or the *female*, was then as usual forming her nest. But I did not capture either of them, because I thought they would make more cells, and I should have frequent opportunities for doing so. Should either of them return, I will take care and secure it.

"I yesterday (22nd July 1845) opened one of the cells, when I found only a single *larva*, which is soft, yellowish-white, apodous, and resembling that of the *common wasp*. The entire cell was lined with a white membrane; but I did not notice, after the most minute examination, any fly, spider, or any remains whatever of any insect, and no egg. This was the *same* cell which I mentioned in my last letter as that in which I saw the *female* Crabro sitting, and then closing up its top.

"I have thought it better to send you herewith pieces of the nest, from which you will see how it has been formed of clay and sand; and you will also observe a part of the membrane which lined the inside of the cell. The *larva* (also inclosed) was at first quite alive; but, owing to my having injured its head as I was opening the cell, it became yesterday evening nearly motionless. I observed, in using a strong lens, that here and there some pieces of sand do not fit quite close, and are unfilled up with clay; this will *allow a little air to reach* the inside of the cell.

"The cells are of an elongate-ovate form, varying from $\frac{5}{8}$ths to $\frac{7}{8}$ths of an inch in length, the four being applied side to side and measuring $1\frac{3}{4}$ inch across their upper part, each cell being about $\frac{3}{8}$ths of an inch across, and the diameter of the interior of the cell which I opened being about $\frac{1}{4}$th of an inch. The exterior surface of the nest projects from the surface of the wall about $\frac{3}{8}$ths of an inch. Each cell is quite separated from the adjoining one and has no internal communication with the other.

"The tree in which I saw the sparrows on their nest, pulling about the nest of the *Vespa Britannica*, is a large pear-tree trained against the wall of my house: I examined the nest in which the sparrows were, but found no remains of the wasp's nest, only three gaping unfledged sparrows, and many feathers, some pieces of paper and cloth, to keep them warm and snug; and I likewise examined the tree around, in order to discover the *peduncle* of the wasp's nest, but I could see no traces of it. The wasp's nest had then been brought from some of the neighbouring trees or shrubs; this could easily be done, as it is extremely *light*, and measures only about 2 inches in its *larger* diameter, and about $1\frac{5}{8}$ inch in its *smaller* diameter."

November 3rd.—The Rev. F. W. Hope, President, in the Chair.

It was announced that the second part of the fourth volume of the Transactions was ready for delivery to the members.

Mr. Tatham exhibited several splendid species of *Carabi*, one belonging to a new species recently received from China.

The President exhibited a box of insects received by him from Dr. Savage, collected at Cape Palmas, containing a new Goliath beetle. Also several boxes of insects recently forwarded from Landour in the East Indies by Mr. Benson, including several new species of *Coleoptera*.

A letter from Captain Boys, on the habits of various Indian species of insects, addressed to Mr. Westwood, was read, dated from Simla in the Himalayas, August 2nd, 1845:

"It is a curious fact, of which I have undoubted proof from ocular demonstration, that both male and female insects of the genus *Copris* are mutually employed in forming the casing of earth after the deposition of the ova within the cowdung. When at Mhow, in search of scorpions on the bank of a rivulet, in turning up a large stone I exposed the perpendicular section of an excavation formed

by them, and which was about two feet from the upper level, immediately below a large dropping of cowdung. The stone was on the slope of the bank, the cavity containing four balls, two nearly finished and two about half-size. The male and female were hard at work, and after a little surprise at the light, continued the operation of adding earth to the smallest ball; this was performed by rolling it round and round, scraping up the mud which gathered, and by pattering it firmly with the fore and hind tibiæ. When I use the word pattering, I only mean to say the insects kept their legs in constant motion on the ball, as obtains in *Sisyphus* when rolling its pill; but in order that it should collect more earth, the male was frequently employed in digging beneath it. I could not detect the female in the act of depositing her ova. One side of every ball is very thin (comparatively), which leads me to believe that on this side the ova is placed. In forming the nucleus of cowdung, the female is the principal worker; she rolls it round and round, digging occasionally, so as to let it sink as the earth is thrown up above, and in this work the male also assists.—The small insect allied to *Aphodius* (*Chætopisthes fulvus*, Westw.) is one of our commonest, though not indigenous to these hills at *this* height: it abounds in horse- and cow-dung.—A small species of *Tridactylus* is also very common; during the rains, with a sheet and a lantern, myriads may be taken. Was it perfect or in the larva state? or rather I should ask if the wing-cases were black?—The larva of *Heterorhina Roylii* to my knowledge may become a pupa, and *perfect from the pupa* in less than two months, however long it may have been in the larva state.—I arrived here on the 1st of June, and collected a great number of larvæ of all sizes, which I brought home, accompanied with the rotting debris of oak-dust in which I found them. Of these, six formed cocoons of the earth and oak-dust, and two were perfect the day before yesterday, and two more came out *yesterday, but were not H. Roylii,* though certainly I could in nowise distinguish a difference in any of the larvæ. One was a bronzed *Cetonia* (*Heterorhina*?) with faint white lines on the elytra and thorax; the other a bronzed green with spots.—Does the Atlas moth feed on oak-trees in its larva state, or on the hill species of *Berberis*? At Almorah I took the cocoon from the latter, but never saw the larva; here I have taken the insect in the latter stage (at least I conjecture it will turn out to be the moth in question) on the oak, and the cocoon looks very like what I took at the former place. The larva of the one now alluded to is very like the one which forms the Tussa silk (I believe an *Actias* also), but the nidus is like whitey-brown paper and no thicker, in this respect resembling that formed by *Actias Luna*, but the caterpillar is not the same.—I heard a few days ago from a friend (W. Benson, Esq.), that a novel species of *Trictenotoma* had been captured in his neighbourhood (Mussoorie), as also either a variety of, or novelty allied to, *Geotr. longimanus*. The former he describes to me as more nearly allied to the *Prionides* than to the *Cerambyces*, though possessing connexion with the *Lucani* as far as the antennæ are concerned. The

thorax in his specimen is strongly *toothed* as in many species of *Prionus*.—From the body of an unfortunate goat, carried off by a leopard some days since, I have lately taken three species of *Necrophori*; one species large, *i. e.* $1\frac{1}{2}$ inch, and wholly black; the second black with red patches, $\frac{3}{4}$ inch; and the third I suspect is a shade removed from, or may be, a *Necrodes*. The male and female are both black, but the former is easily distinguished by the form of the posterior thighs, which are strongly incrassate. All these insects if not very strongly pressed when taken *smell of musk*, but their stench is intolerable if roughly handled. A largish species of red ant forms its nest among the leaves of mangoe trees. I have not yet met a description of it, though it cannot have escaped so long, being not only common, but the insect is a perfect nuisance to all pic-nic-ians, and must have drawn attention. The *queens* or females, when winged, are a very fine apple-green in the colour of body. I took them from the nest near Mhow at several times. The web which they elaborate from the *mouth* will bear writing on, and take ink as legibly as paper. I never saw any but red workers making the web. In this country the natives use them for the purpose of getting rid of wasps' nests (though I do think the remedy equally bad with the cure). The branch on which the colony has formed its leafy home is carefully cut through and transported to the vicinity of the wasps, and in a few days a total extirpation of the latter ensues. The ground is covered with the bodies of the *Vespæ*, and the ants go about biting every *human* being that they happen to crawl on. Is not the remedy as I stated? It is however only used when the wasps are in a chopper or thatched roof, and not easily to be got at for extirpation. I have never observed their nests but on the mangoe tree and *Ficus Indica*. I would wish to know if the common cabbage in England is ever infested with an apode (?) *Acarus*, or something allied thereto, and resembling a flask. *Here* I have taken them for the first time, and for some time doubted my own eyes, even with a microscope to help them. The creature is fully one-third of an inch long, but the snout or mouth is so minute as to require the aid above-mentioned*.—I have lately taken quantities of *Colliuris*; the larger one with black legs is a different species from those with red. Of this I doubted some time ago, but all my suspicions are now perfectly set at rest."

December 1st.—The Rev. F. W. Hope, President, in the Chair.

Mr. Bedell exhibited a specimen of *Anacampsis alacella* of Zeller and Fischer, a species new to Britain, which he had captured on Leatherhead Common on the 17th of August last.

Mr. Edward Doubleday exhibited a box of *Lepidoptera* from the highest range of the Rocky Mountains in North America, collected by Mr. Burke, the majority of which were strikingly analogous to European species, including a species of *Parnassius*, a genus hitherto found only in the Old World, although Dr. Boisduval had suggested

* [Probably a female *Coccus* of an undescribed species.]

the probability of its existence in the northern parts of America. Also a box of *Lepidoptera* from Borneo, collected by Mr. Hugh Lowe, jun.

The following memoirs were read:—

"Descriptions of a new Longicorn Beetle (since published in the 'Annals of Nat. Hist.') and of a species of *Lucanidæ* (*Lucanus macrognathus*) from Borneo." By Adam White, Esq.

"Descriptions of two new Goliath Beetles from Cape Palmas, in the Collection of the Rev. F. W. Hope." By J. O. Westwood.

SMICORHINA, Westw.

Corpus oblongum, depressum, supra velutinum, lateribus subparallelis, pedibus elongatis. Caput in mare laminis duabus parvis horizontalibus in vertice clypeoque in cornu breve recurvum producto. Prothorax lateribus pone medium ferè rectis, margineque postico ferè recto. Processus mesosterni brevissimus. Tibiæ anticæ maris extus tridenticulatæ, intus pone medium serratæ.

Smicorhina Sayii, Hope MS. *Nigra, pronoto sanguineo, vittis 4 nigris, intermediis duabus abbreviatis, capite supra cinereo-velutino, pedibus nigris, femoribus tibiisque sanguineo variis.* Long. corp. lin. 13.—Hab. in Africâ tropicali (D. Savage). In Mus. Hope.

MEGALORHINA, Westw.

Corpus oblongo-ovale, subdepressum, supra velutinum, elytris posticè angustioribus. Caput maris supra ferè planum, denticulis duobus ad marginem internum oculorum, clypeo in cornu valdè elongato apice bifido producto. Prothorax ferè semicircularis, convexus. Elytra subconvexa, velutina, colore pallido guttata. Tibiæ anticæ elongatæ, curvatæ, externè ferè ad apicem emarginatæ, internè serratæ. Processus mesosterni anticè porrectus.

Megalorhina Harrisii, Savage MS. *Supra opaco-velutina, capite supra albo, cornu subtùs castaneo; pronoto brunneo, luteo-marginato; scutello brunneo, elytris olivaceo-nigris maculis numerosis fulvescentibus in seriebus 5 (in singulo elytro) dispositis, pedibus castaneis, tibiis tarsisque 4 anticis nigris tarsis posticis flavescentibus.* Long. corp. (exclus. capitis cornu) lin. 18; latitudo elytrorum lin. 9.—Hab. cum præcedente (D. Savage). In Mus. D. Hope.

"Descriptions of some new *Scutelleridæ* from Cape Palmas." By J. O. Westwood.

After detailing the structural characters of *Plataspis Bucephalus*, White, descriptions are given of two new species of the same genus of large size, collected at Cape Palmas by Dr. Savage, and forwarded by him to Mr. Hope.

Plataspis (Aphanopneuma) biloba, Westw. *Supra obscurè lutea, nitida, depressa, lateribus subparallelis, undique nigro-guttulata, guttulis punctatis, spatio magno bilobo fulvescenti ad basin scu-*

telli, capite maris in lobos duos magnos conicos convergentes productis, spiraculis lateralibus in membranâ tenui ferè inconspicuis. Long. corp. lin. 7.—Hab. Cape Palmas (D. Savage). In Mus. Hope.

Plataspis (Cantharodes) cœnosa, Westw. *Supra obscura sublutescens, opaca, nigro punctatissima, scutello fascia indistincta mediana subpallidiori, capite magno subconcavo, posticè in collum angustato, prothorace anticè valdè emarginato, lateribus rotundatis in medio parum angulatis, pedibus subgracilibus.* Long. corp. lin. 8.—Hab. cum præcedente.

"Note on two species of Moths taken at great distances from land." By W. F. Evans, Esq.

The two insects in question were *Sphinx atropos* and *Porthesia auriflua*. They were caught on board Her Majesty's Ship 'Rodney' (one of the experimental squadron), which left Portsmouth on the 15th of July, and lost sight of land in two days; which they never saw, nor were certainly within 200 miles of, until beating up to Cork in September; and when *at least* forty miles off Cape Clear, wind due east (or off the land), the specimen of *Sphinx atropos* was captured on one of the topmasts.

The specimen of *Porthesia auriflua* was taken from off one of the boats which had been recently tarred, at about the extreme point of the cruise in the Bay of Biscay, and at least 200 miles from land. The sailors called the Sphinx an Irish paroquette. Great difficulty was experienced in killing it, but its death was after some time effected by means of creosote.

Extracts from a letter addressed by Dr. Savage to Mr. Hope on some of the insects of Cape Palmas, dated Cape Palmas, W. Africa, 7th March, 1845. Communicated by the Rev. F. W. Hope.

"Goliathus.—*Ceratorhina frontalis* and *aurata* feed upon a small fig, the fruit of the *Ficus microcarpa*; also the *ciliolosa* and other species, of which we have several. One resembles in its habits the *F. Indica*; so much so, that it had obtained the common name of 'Banyan-tree.' *G. frontalis* feeds also upon the fruit of another tree, belonging to the Linnæan class Pentandria and order Monogynia; further examination of this tree, botanically, I have not had time to make. Upon these fig-trees we find also the *Cetonia guttata* of Oliv., *C. marginata,* the different species of black *Cetoniæ*, green, &c., feeding upon the juices of the ripe fruit.

"I have fully established the point that the *Goliathi* proper feed upon juices; and all the *Cetoniæ* (especially the *Goliathideous* species) that I have captured have been taken in the act of extracting juices from fruits and plants. The tree upon which the *G. Cacicus* is found I suppose to be a gigantic *Eupatorium*, from the juice of the bark of which that insect, and also *Cetonia guttata*, derive their nourishment.

"The *C. guttata* being found upon two different trees, feeding at one time upon the juice of the bark, at another upon that of the fruit, shows the manner in which its food is supplied the year round.

The figs yield several crops during the year, and the different species come to maturity at different times. The *Mecynorhina Savagii* of Harris feeds upon a gigantic climber, which upon being cut yields an astonishing quantity of pellucid water. So abundant is this fluid, and so negative in its qualities, that the natives, when a stream of water is not at hand, resort to it to quench their thirst. (See "A description of an African Beetle allied to *Scarabæus Polyphemus*, with remarks upon some other insects of the same group," published in the Journal of the Boston Natural History Society, 1843, by Thaddeus William Harris, M.D.) I have remarked that almost every individual *Cetonia* that I have sent to England I have found feeding upon the juices of plants; one (*Plæsiorhina mediana*, figured by Mr. Westwood) I captured in a rose-apple, through which it had made a hole; another, an *Heterorhina* (Westwood), I captured in the act of extracting the juice of the Zea maize, having made quite a hole at the foot of the young succulent leaves.

"I also send several pairs of *C. guttata*. One of the individuals of the series (a male) you will find with a different armature on the clypeus from all the others; the clypeus itself is extended, while the central horn remains the same. I have had several hundreds of *guttata* in my possession, but the individual in question is the only one of the kind. Is it simply a variety of *guttata*? It was captured with *guttata* proper, and brought to me by my collector with not less than fifty specimens of that insect. October and November are the months in which *frontalis, aurata* and *guttata* have been found most abundantly this year.

"APIDÆ.—I send eight specimens of the best honey-bee of this region; it is that from which the wax of commerce (as I suppose) is derived. The local name at this point (region of the Grebos) is 'Duh' (pronounced Dōh). The natives (I speak only of this tribe (Grebos), the native inhabitants of Cape Palmas) do not domesticate them. Occasionally a hive will be seen in a Gregree or Fetish house, attached or placed there, and looked upon as a sacred object. I have known only one instance, that of a noted doctor, when it was made a private Fetish. Their sting, it is said, is very severe and much dreaded by the natives. They make their nests generally in the cavities of old trees. I have succeeded in taking one swarm and domesticating them. When the natives desire their honey, they make a bundle of splintered bamboo, about six or ten feet in length, and, setting one end on fire, apply it to the entrance of the nest, which soon destroys them. The wax is not an article of commerce here, and is used to a very limited extent among the natives. The principal use by them is to make tight small boxes, &c., to protect their contents against the bad effect of water on the sea as they go off to vessels.

"There is a second species, the local name of which is 'Nuh' (pronounced Noo), about the same size as that of Duh. It is of a darker aspect, as also its wax, which is held in no estimation by the natives. This bee is said by some to be stingless; I am unable to decide this point.

"A third species exists, very small indeed, of a very light colour, approaching closely to white; local name 'Dafre' (pronounced Darfray). It attaches its nest to the surface of trees, and delights in lofty positions. The nest varies in size from a man's fist to three or four times that size, and is very light in aspect, nearly white. All admit that this bee is stingless. I regret that I have no specimen at hand. I mention these different species at the present time, simply because I have forwarded them in the box.

"A fourth species is found with the local name 'Vranh'; French sound, the *an* sounded like *an* in 'franc.' Many of the natives pronounce it as if written with *f*, Franh. This species burrows in the soft sticks of which the rafters in the natives' houses are made. They take a longitudinal direction, and extend from three to ten inches in length. They have the diameter of a bullet; sometimes two will be seen parallel. At the end will be found a shallow excavation, in which are deposited the eggs, and which are separated from the main cell by a perpendicular division, consisting of the fine particles of the wood made in process of excavation, united by some agglutinal, which no doubt they have the power of secreting. One of the specimens sent differs from the others. Is it not a male? It was found in the same nest with the others."

MICROSCOPICAL SOCIETY.

Oct. 14, 1846.—J. S. Bowerbank, Esq., F.R.S., President, in the Chair.

A paper by John Anthony, Esq., "On a Method of rendering the Appearances in delicate Structures visible by means of oblique transmitted light."

This method depends upon the placing the object in such a position that the fine lines or other delicate markings are exactly at right angles to the illuminating rays, when these lines, &c. will be at their maximum of distinctness, and thus tissues may be rendered distinctly visible whose existence when viewed in the ordinary manner might be considered as exceedingly doubtful. The object employed to illustrate this position was the Navicula of the Humber, one of the most delicate of test objects, which under ordinary circumstances appears perfectly transparent, but when viewed in this way, not only exhibits a double set of lines but also transverse lines, giving the whole the appearance of being covered with a delicate net-work. Four drawings of this object were exhibited, showing it in as many different positions, making a complete revolution of the field in which the markings just mentioned were distinctly visible. In order to bring out these appearances, it is necessary that the light should be very oblique, and must be passed laterally through the "bull's eye," in such a manner that the object (the Navicula) may appear of an intensely blue colour nearly opake. The stage is then to be gradually turned round until the shell is in the position to be best seen as described.

MISCELLANEOUS.

ON THE HABITS OF THE LIMPET.

Lyme Regis, Oct. 10, 1846.

Dear Mr. Dean,—The limpets have engaged my attention, but the wall newly-built has been thrown down by a great gale. I find limpets to be very intelligent creatures, and I justify the term from finding them suit their habits to their locality: thus some placed upon a tolerably smooth surface out of the stroke of the breakers move and halt anywhere as their choice leads them.

They move out of the water at a steady pace, about half as fast as a house snail; a foot distance is consequently soon accomplished. In some situations I could not see what made them start off or halt, whether to feed or for any other purpose.

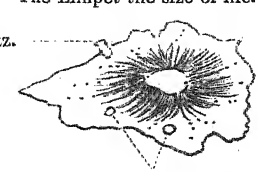
I do not think limpets move about much when the tide is in and their enemies the crabs near. I have often admired their clever manner of *slewing* themselves round without moving from the spot.

I again repeat, the limpets I have specially watched do move about, and if upon a smooth surface halt anywhere: now for a little discovery I made.

On the slope of a great cockle rock (higher greensand rock from Whitlands) at the end of the Cobb, is a basin-like depression which is left partly filled with water. One fine day I climbed up and found in the basin and round about several small and a few middle-sized limpets. Above the level of the water (the basin) was a smooth place from which a limpet had not long before moved, as the spot was different in colour to the rock around; the shape was singular. Looking into the water I saw several limpets there, and a good many little fæces of these creatures. I was not long in spying my friend, who was from home. I found him leaving the others and making his way steadily back to his habitat. I watched his course; he arrived, and I at once perceived a difficulty, which he made nothing of, viz. the getting adjusted. He slewed himself round and fitted a little notch which he had to a small piece of projecting quartz with wonderful readiness. He was tight in a moment, ready to resist the heaviest breakers or any enemy.

I give you a sketch to show how peculiar the shape was, which is not unusual in limpets fixed to cockle and Portland stone, in which are shells, chert, and in the former quartz, which they cannot corrode like the other parts.

The Limpet the size of life.

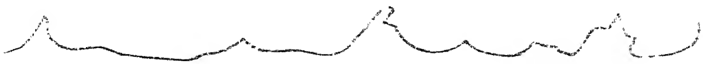


I find this limpet descended daily into the little basin of water, met his fellows there, and duly travelled back before the tide came in, and fitted the notch to the piece of quartz as before described.

I believe his disappearance in October is due to some interference with him or her made by one of my pupils who had seen me visit the spot, perhaps to try how far the creature would travel back to his habitat.

I have found some depressions in the Portland blocks made by limpets within the last fifty-five years very surprising for their extent.

Edge of the stone originally when first worked.



The lower line shows the present outline, the intervening matter having been worked away by limpets.

I am, dear Mr. Dean, your faithful Servant,

GEORGE ROBERTS.

Very Rev. Dr. Buckland, Dean of Westminster.

METEOROLOGICAL OBSERVATIONS FOR NOV. 1846.

Chiswick.—November 1. Foggy. 2, 3. Very fine. 4. Overcast. 5. Foggy and drizzly. 6, 7. Foggy: hazy. 8. Foggy. 9. Hazy and cold. 10. Dusky clouds: fine. 11. Cold and dry. 12. Overcast. 13. Hazy. 14. Foggy. 15. Cloudy. 16. Overcast: cloudy and fine. 17. Densely overcast: slight rain at night. 18. Cloudy: very fine. 19. Cloudy and damp: very fine. 20. Cloudy: boisterous. 21. Very fine: rain. 22. Fine: clear. 23. Slight rain: overcast. 24. Hazy and damp: rain: overcast. 25. Rain. 26. Clear and fine: foggy. 27. Dense fog. 28. Clear and fine. 29. Frosty: clear and fine. 30. Sharp frost: overcast.

Mean temperature of the month .... 44°·53
Mean temperature of Nov. 1845 .... 44 ·26
Mean temperature of Nov. for the last twenty years ... 42 ·91
Average amount of rain in Nov. .... 2·56 inches.

Boston.—Nov. 1. Foggy. 2. Fine. 3, 4. Cloudy. 5. Fine. 6—9. Cloudy. 10, 11. Fine. 12—14. Cloudy. 15. Cloudy: rain P.M. 16. Cloudy. 17. Cloudy: rain P.M. 18. Cloudy. 19. Fine. 20. Stormy. 21. Cloudy: rain P.M. 22. Fine: rain P.M. 23. Cloudy: rain P.M. 24. Fine. 25. Cloudy. 26. Fine. 27. Cloudy: rain A.M. and P.M. 28. Cloudy: snow P.M. 29. Fine: snow on the ground. 30. Fine: melted snow in the gauge.

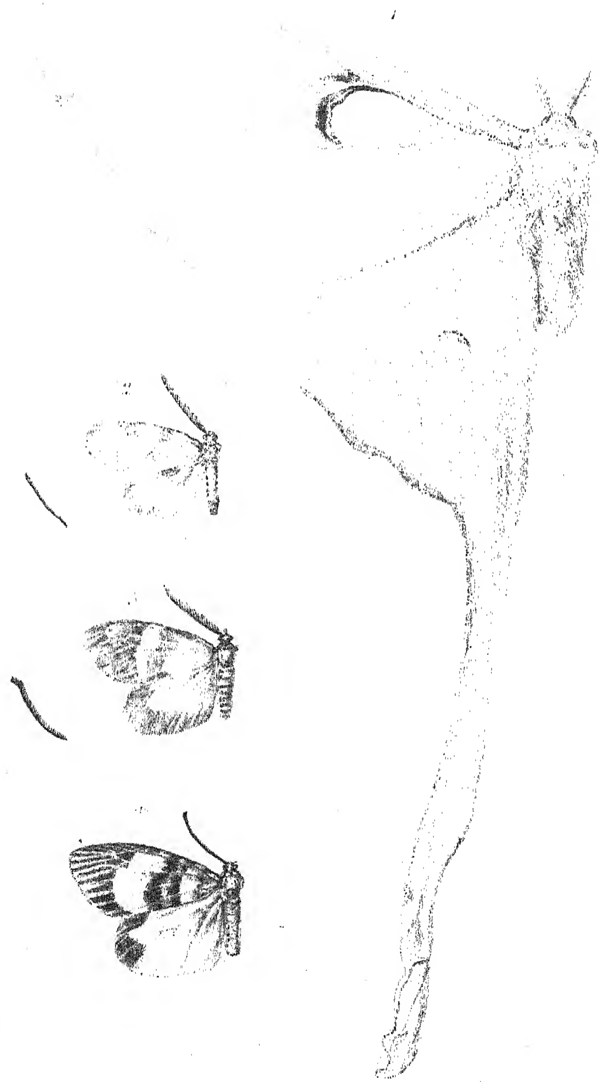
Sandwick Manse, Orkney.—Nov. 1. Showers: cloudy. 2, 3. Cloudy. 4. Bright: rain. 5. Bright: cloudy. 6. Hazy: rain. 7. Bright: showers. 8. Bright: clear: fine. 9. Clear: very clear and fine. 10. Hoar-frost: cloudy: fine. 11—15. Cloudy: fine. 16. Bright: clear: aurora. 17. Rain: clear: aurora, south. 18. Clear: showers. 19. Clear: aurora. 20. Rain: showers. 21. Showers. 22. Rain: clear. 23. Damp: cloudy. 24. Showers. 25. Showers: cloudy. 26. Showers. 27. Hail-showers. 28. Snow: hail-showers. 29. Snow-drift: clear. 30. Cloudy: shower: thaw.

Applegarth Manse, Dumfries-shire.—Nov. 1. Slight showers P.M. 2. Showers morning and evening. 3. Rain P.M. 4. Moist A.M.: rain P.M. 5. Showers. 6. Fair, but moist. 7. Fair, but dull and cloudy. 8. Fair and fine. 9. Fair, but cloudy. 10. Hoar-frost: clear and fine. 11. Fair and fine: hoar-frost A.M. 12—15. Fair, but dull. 16. Clear: piercingly cold. 17. Wet. 18. Showers. 19. Heavy rain. 20. Heavy rain: river in flood. 21. Heavy rain: thunder P.M. 22. Rain. 23. Heavy rain. 24. Rain A.M. 25. Rain and fog. 26. Dull and drizzly. 27. Fair. 28. Frost: shower of snow. 29. Hard frost: clear. 30. Frost: thick and foggy.

Mean temperature of the month .... 44°·4
Mean temperature of Nov. 1845 .... 42 ·7
Mean temperature of Nov. for 23 years .... 40 ·2
Mean rain in Nov. for 18 years .... 3·63 inches.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse,* Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston, 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston, 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick, 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1846. Nov.	Max.	Min.		9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9¼ a.m.	8½ p.m.								
1.	30·043	29·959	29·67	29·73	29·68	29·66	29·56	52	34	38	53½	50	52	53	s.	calm	sse.	sse.				·20
2.	29·934	29·911	29·61	29·70	29·64	29·76	29·72	59	49	47	54	49	50	52	s.	calm	se.	se.				·19
○ 3.	30·050	29·991	29·58	29·78	29·73	29·80	29·87	61	39	52	55	43½	52½	49	s.	calm	ese.	sse.				·04
4.	30·096	30·053	29·70	29·78	29·83	29·84	29·87	60	42	51	57	50	52	52½	s.	calm	se.	se.	·02			
5.	30·157	30·131	29·65	30·00	29·96	30·06	30·05	59	41	52·5	57	47½	50	52	se.	calm	se.	se.	·01			·12
6.	30·149	30·146	29·76	29·98	30·00	30·04	29·93	46	40	49	55	51	52	50½	se.	calm	ese.	sse.				
7.	30·269	30·222	29·84	30·08	30·18	30·05	30·18	44	42	46	51	44	51	51	se.	calm	ese.	wsw.				·30
8.	30·387	30·338	29·93	30·23	30·30	30·32	30·36	47	41	44	56½	48	50	45	e.	calm	n.	se.			0·60	·07
9.	30·449	30·429	30·05	30·35	30·37	30·39	30·42	43	34	45	49	40½	47½	43	e.	calm	e.	se.				
☾ 10.	30·444	30·396	30·21	30·40	30·39	30·46	30·47	49	38	45	48	30	43½	46½	e.	calm	ene.	e.				
11.	30·278	30·258	30·02	30·39	30·35	30·47	30·48	51	38	48	50½	32	46½	45	e.	e.	ne.	e.				
12.	30·343	30·314	30·00	30·40	30·38	30·50	30·51	51	43	49·5	47	42	45	45	ne.	calm	ene.	s.				
13.	30·343	30·303	30·04	30·35	30·30	30·46	30·39	47	44	50	48½	46	47	47	e.	calm	ene.	n.				
14.	30·271	30·216	29·95	30·23	30·20	30·30	30·28	49	37	46	47	42	47½	46	ne.	calm	ene.	s.				
15.	30·162	30·122	29·77	30·10	30·05	30·23	30·17	48	40	47	45	41	46½	46	e.	e.	e.	sse.			0·00	
16.	30·128	30·065	29·83	29·95	29·75	30·04	29·80	48	39	48	48½	40	47	48	se.	calm	e.	sse.		·05		
17.	29·902	29·848	29·51	29·54	29·59	29·56	29·52	51	39	45	52½	41	49½	48	s.	sw.	e.	s.	·02			·04
● 18.	29·828	29·487	29·45	29·52	29·40	29·51	29·36	58	44	49	54½	48	47	49½	s.	calm	se-sse	sse.	·06	·08		·12
19.	29·810	29·768	29·32	29·42	29·40	29·29	29·27	56	48	48·5	51	45	47	45½	sw.	calm	se-sse	ssw.				·02
20.	29·434	29·295	29·00	28·98	28·70	29·12	28·87	54	43	51	53	47	49	47	sw.	s.	ese,sw	se.	·06			·06
21.	29·631	29·530	29·24	29·24	29·17	28·91	29·13	53	39	46	50½	43½	48½	45	sw.	calm	sw-se.	ssw.	·37			·45
22.	29·579	29·366	28·96	29·10	29·33	29·03	29·19	55	39	44	47½	38	43	45½	w.	sw.	wsw.	nw.	·04	·09		·10
23.	29·799	29·711	29·45	29·52	29·45	29·50	29·51	51	49	42	48	35	46	41	sw.	calm	ese.	se.	·07	·12	1·05	·08
24.	29·696	29·580	29·19	29·34	29·45	29·33	29·37	56	46	52	53½	40	47½	49½	sw.	calm	wsw.	w.	·50	·45		·11
☽ 25.	29·663	29·260	29·29	29·38	29·06	29·36	29·26	52	43	48	48	41	45	44	s.	calm	e.	e.	·27	·01		·26
26.	29·252	29·232	28·82	29·03	29·12	29·17	29·41	56	30	46	47	42	45	43	sw.	calm	nw.	nne.	·01	·17		·06
27.	29·348	29·306	29·00	29·28	29·42	29·65	29·58	44	32	42	45½	42½	40	33	sw.	calm	nnw.	n.				·13
28.	29·544	29·402	29·16	29·38	29·58	29·67	29·83	45	22	36·5	38½	27	35	33	n.	calm	n.	n.		·43		·29
29.	29·799	29·710	29·46	29·68	29·75	29·84	29·96	37	16	32	36½	28	33½	30½	n.	calm	nw.	ne.				·02
30.	29·949	29·848	29·62	29·86	29·82	29·92	29·57	34	27	30	35	27½	35½	44	n.	calm	nnw.	w.		·30	1·90	·61
Mean.	29·957	29·873	29·56	29·759	29·745	29·808	29·796	50·46	38·60	45·6	49·4	41·4	46·38	45·66					1·43	1·70	3·55	3·27



Hullmandel & Walton Lithographers

THE ANNALS

AND

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No. 124. FEBRUARY 1847.

VII.—*Descriptions of some new species of the genus* Gynautocera, *from Northern India.* By Edward Doubleday, Assistant in the Zoological Department of the British Museum, F.L.S. &c.

[With a Plate.]

Genus GYNAUTOCERA, *Guérin.*

Section Amesia, *Hope.*

Gyn. Namouna. Alis omnibus fuliginosis, anticis punctis sex minutis pone cellulam albidis, posticis maculis disci cæruleis, margine externo linea alba cæruleaque profunde dentata notato. ♀. Exp. alar. 4 unc. vel 100 mill.
Hab. India Septentrionali.

Anterior wings fuscous black, with six minute white spots edged with blue, placed between the nervules immediately beyond the cell. Posterior wings of the same colour, with four blue spots placed transversely a little beyond the middle, two similar spots at the end of the cell, of which the inner is pupiled with white. Between the cell and the outer margin is a deeply zigzag line, the outer angles upon the ends of the white slightly bordered with blue, the inner between the nervules bright blue, embracing a series of fine white spots; anal angle gray.

Below, black, all the wings bordered with white; nervules of anterior wings slightly, of posterior very distinctly bordered with white.

Head, thorax and abdomen black above, spotted with blue below, the terminal segment of the last blue. Antennæ and legs blue.

In the collection of the British Museum.

The marginal band of the posterior wings very much resembles that of the two common species of the genus *Thais* in form.

Gyn. Aliris. Alis omnibus supra fusco-nigris, anticis maculis quatuor basalibus roseis, apicalibus plurimis albido-cæruleis, posticis margine externo læte et late cæruleo, maculis albis. ♂ ♀. Exp. alar. $3\frac{1}{2}$ unc. vel 90 mill.
Hab. Silhet.

Anterior wings fuscous black, with a chocolate or vinous hue in certain lights; the base darker, with several small bright blue dots, followed by four rosy spots, one on the costa, one nearly opposite to this below the cell, two in the cell rather farther from the base; the margin with a series of white dots divided into two parts by the nervules and bordered with blue, between which and the cell are six small dots placed in two transverse series, and also a seventh placed more internally near the third of the inner series. Posterior wings of the same colour, with a broad blue patch commencing on the costa beyond the middle, occupying the outer angle and extending along the outer margin nearly to the anal angle, preceded by one or two detached spots of the same colour, and marked by a series of submarginal white spots, preceded by three others of the same colour near the apex.

Below, the posterior wings want the blue border, have the anal angle blue, a red spot in the cell followed by four blue ones with white centres; the anterior wings have the spots larger and bluer than above, and also have several additional spots on the disc.

Head, thorax and abdomen black, spotted below with white, the terminal segment of the last shining olive-green, especially in the males. Antennæ blue, pectinated in both sexes, not differing remarkably in their structure.

In the collections of the British Museum, Dr. Boisduval, &c.

Closely allied to *B. Sanguiflua*, Drury (*Am. Sanguiflua*, Hope), but at once known by the absence of the purplish red veins.

Gyn. Azim. Alis omnibus utrinque fuscis, maculis numerosissimis flavidis adspersis, anticis basi fascia transversa flava. ♀? Exp. alar. $3\frac{1}{2}$ unc. vel 90 mill.
Hab. India Septentrionali.

Wings fuscous black, somewhat diaphanous: the anterior with numerous pale yellowish spots, viz. a series of small rounded dots between the costa and costal nervure, alternating for some distance beyond the base with a series between the costal and subcostal nervures, two series in the cell, of which the upper are elongate-quadrate, the first and second of the lower series round, the first being very small, the third almost reniform, the fourth, fifth and sixth elongate, and the second round; a series of rounded dots in the interstices between the subcostal and discoidal nervules, a similar series and a solitary spot in that between the se-

cond discoidal and the third median nervules, a double series in the interstice between the second and third median nervule, the upper consisting of five, the lower of four rounded spots, and between these near the cell a solitary spot; in the next interstice a series of five and another of three spots, followed by two very minute ones near the margin; in the interstice above the submedian nervure a series of fifteen spots, the first round, as are also the six outer ones, the last of all very minute; a rounded spot at the origin of the first median nervule; in the interstice below the submedian nervure and along the inner margin two other series of spots, the upper composed of fifteen, the lower of ten, the five outer of the first and four outer of the inner series rounded. The posterior wings have two series of suboval spots in the cell, the last but one of the inner series being small and placed a little out of the straight line.

Head, thorax and abdomen black, spotted with white. Antennæ black.

In the collection of H. G. Harrington, Esq.

The only specimen I have ever seen of this curious species is the one from which the above description has been taken: unfortunately the posterior wings are much injured.

Gyn. Camadeva. Alis anticis trigonis, nigris, puncto minuto in cellulam, quinque pone cellulam, duobusque anguli anali albidis posticis saturate cæruleis fimbria nigra. ♂. Exp. alar. $2\frac{1}{4}$ unc. vel 55 mill.

Hab. Penang.

Anterior wings elongate, trigonate, black, a minute spot near the end of the cell, five rather larger oval ones beyond the cell and two near the anal angle, pale, subdiaphanous. Posterior wings rich deep blue, with a narrow black border.

Below, the anterior wings are bright blue with the apex fuscous, the markings of the upper surface reproduced more clearly, and besides there is a yellow vitta in the cell at the base, an irregular spot in the cell, and an indistinct cloud below it of the same colour. Posterior wings blue, with a black border, three yellow vittæ at the base, an irregular yellow spot in the cell, between the cell and the nearest vitta two spots of the same colour, the first small, the second large, oval; on the anterior margin near the outer angle a large white spot, preceded by a black cloud and some white atoms; about the middle of the outer margin two white spots, the inner preceded by a black ocellus pupiled with white.

Head and thorax black above, yellow below. Antennæ blue. Abdomen blue above, yellow below.

In the collection of the British Museum.

Gyn. Adalifa. Alis omnibus albidis, anticis nervis, nervulis, fasciaque transversa nigris; posticis nervulis cæruleis, fascia transversa nigra, angulo anali flavo. Exp. alar. 3 unc. vel 74 mill.
Hab. Silhet.

Anterior wings white, slightly tinged with yellowish, the nervures and nervules of a greenish black; a waved band of the same colour extends from the costa across the end of the cell, and is continued onwards as far as the first median nervule of the posterior wings. Posterior wings of the same colour as the anterior, broadly yellow at the anal angle, the subcostal and median nervures and nervules and the discoidal nervule bluish green.

Below, the anterior wings have a basal black vitta along the costa, and the base of the cell is greenish.

Head green; thorax black, prothorax crimson; abdomen pale.

In the collection of the British Museum.

Section Chalcosia, *Hübn.*

Gyn. Zuleika. Alis omnibus albis, anticis fimbria lata marginis externi nigra, aureo-viridi notata, basi, fasciaque media transversa, aureo, nigro, viridi, cæruleoque variegatis, posticis apice late nigro, cæruleo vittato. Exp. alar. 2 unc. vel 50 mill. Pl. VII. fig. 4.
Hab. Silhet.

Anterior wings with the base of a bright golden green, the green colour bounded externally by bright blue varied with black and green; beyond this a wide space of a very light cream-colour or almost of a pure white, then a broad transverse band of a bright golden green, bordered on each side with black, divided by blue nervures and shaded with blue. The whole outer margin broadly black, the black extending more along the costa than the inner margin, glossed with blue and divided by broad golden green lines along the nervules. Posterior wings white, the apex broadly black, divided by blue lines along the nervules; the cilia white.

Below, anterior wings nearly as above but less brilliant, the white space near the base yellowish, the apex white. Posterior wings white, immaculate.

Head, thorax and base of abdomen gold-green, abdomen except the base pale. Antennæ blue; legs white.

In the collection of the British Museum, &c.

Gyn. Zelica. Alis anticis nigro-fuscis, macula magna baseos, fascia media transversa maculisque tribus apicalibus albis; posticis albis, fimbria lata nigro-fusca. ♂ ♀. Exp. alar. 2—2½ unc. vel 50—65 mill. Pl. VII. fig. 3.
Hab. Silhet.

Anterior wings black, with slight bluish or greenish reflections,

the base with a large white spot not reaching the costa, the middle with a broad white band, the apex with three white spots placed transversely, less distinct in the males than in the females; the apex in the females white. Posterior wings white, with a broad black fimbria; the apex in the females white.

Below, colours and markings as above, but greener.

Head blue; antennæ very deeply bipectinated in the males, much less so in the females except at the apex.

Thorax green anteriorly. Abdomen of the male yellow, with a black transverse band on each segment above. Abdomen of the female white.

Gyn. Zenotia. Alis omnibus subdiaphanis albidis anticis vitta ad basin costæ, maculis duabus costalibus, altera marginis interni, aliquotque marginis externi nigris; posticis macula costali apiceque nigris. Exp. alar. $1\frac{1}{2}$—2 unc. vel 40—50 mill. Pl. VII. fig. 2.
Hab. Silhet.

Anterior wings somewhat diaphanous white, the costa from the base to about the middle black, marked before the middle and beyond the cell with a large subquadrate black spot; the outer margin towards the apex with two black patches, below which are some irregular black spots; on the inner margin near the middle is a large black spot divided by a nervule, and between the cell and the anal angle another smaller oval one. Posterior wings with a fuscous black spot near the costa, the apex also fuscous.

Below, as above.

Antennæ of the male large, very deeply bipectinated; of the female less deeply except at the apex.

Section Heterusia, *Hope*.

Gyn. sex-punctata. Alis omnibus luteis anticis pone medium punctis duobus, posticis unico nigro cærulescentibus. Exp. alar. $1\frac{1}{2}$ unc. vel 40 mill.
Hab. Silhet.

All the wings luteous above, with two small bluish black dots between the end of the cell and the anal angle of the anterior wings, and one in a similar position on the posterior. Below, rather paler, with a second indistinct spot on the posterior wings.

Head and prothorax bright red. Antennæ bluish black. Abdomen black at the base with white rings, beyond white with black rings.

In the collection of the British Museum.

The colour and markings of this species strikingly resemble those of some *Lithosiæ*.

VIII.—*Horæ Zoologicæ.* By Sir WILLIAM JARDINE, Bart., F.R.S.E. & F.L.S.

[Continued from vol. xviii. p. 121.]

Ornithology of the Island of Tobago.

TROGON COLLARIS, *Vieill.* S.*

MR. KIRK says in one of his early notes, "very rare," but from the number of specimens received from him and seen in his possession, we judge he had not at that time discovered their locality in the island. Mr. Gould, in his beautiful monograph, gives Brazil and Cayenne as the true country of the species, and states, "from any localities to the north of which countries I have never seen specimens." The white spot posterior to the eye of the female, and ring of white feathers encircling it, do not appear in those figures.

We have been able only partially to examine the structure of this bird, and feel much inclined to agree with those who place the Trogons with the Fissirostres. The very tender skin and loose soft plumage, the habits partially nocturnal, or frequenting thick and shaded woods, and the generally insectivorous food, assimilate them with the *Caprimulgidæ*, while the observations of Mr. Eyton place them among the Kingfishers. We may be able to illustrate this more fully ere long, but may in the meantime state that the tongue is short, bifid at the tip, thick and muscular at the base; the stomach round and slightly elongated, and in all that were opened contained the remains of Grylli, Lepidoptera and caterpillars; in one only a few seeds were found; the cæca are about one half the length of the space between their origin and the anus; the whole general structure weak. Mr. Kirk remarks in one letter, "This bird has the most tender skin of any I ever attempted to skin; the note is four distinct shrill mournful whistles diminishing in duration; I cannot describe it better than by saying it is four notes of E natural on flageolet, which I have this moment tried;" and in another he observes, "The orbits of the female, encircled by a single row of white feathers, terminating a little broader towards the corner of the eye backwards, have the appearance at some distance of a white spot. Feed upon berries and fruit; are remarkably stupid; I have frequently called them half a mile distant and brought them within twenty yards. Their note is four distinct *hoo, hoo, hoo, hoos,* which they cease as soon as they see the person calling them, but seem to apprehend no danger, as they generally sit

* Species marked N. are also found in North America; S. in South America; and N. S. in both.

and look down with deliberate stupidity; their flights are short and frequent."

PRIONITES BAHAMENSIS, *Swain.* (King of the Wood.) s.

We have never received this closely-allied species from the continent of South America; Swainson gives the Bahama Islands as its principal locality, and in addition to those from Tobago we possess specimens from the island of Trinidad; one of the latter is varied on the wings with white.

In vol. vi. p. 321 of these 'Annals' we gave an account of the habits of this species from the notes of our correspondent, to which we refer our readers; the following additional information in regard to their nidification was received in a subsequent letter. "I think I can now happily afford you all the information you require regarding this bird; on the 11th of June I shot No. 172, and found her nest close by from the curring sound kept up by the young. After examining the diameter of the entrance, which was only $2\frac{1}{2}$ inches, I dug into a marl bank 5 feet direct back, and 5 feet farther at a direct angle, the passage considerably larger at the angle and again considerably larger at the farthest extremity, where I found three young huddled up on the top of a moving mountain of maggots, claws and remains of beetles and various other insects. They feed also upon various kinds of berries: I found in the stomach of the parent a berry of which the French used to make soup when in the island, and which the negroes use at this day. The cat killed one of the young after flying about the house quite domesticated: they look upon man as their natural protector, and have become very tame; I have taught them to eat pottage, but they prefer animal food. All their food is taken in the point of the bill, and with a toss of the head as it were pitched into the throat*. They are particularly fond of lizards, snakes, &c., and must at times dig in the ground after insects, as I have sometimes surprised one, and on examination found the bill dirty as high as the eyes. My object in rearing the young was to ascertain if they actually stript the two tail-feathers with their bills, which is a common report; but having no convenient aviary, and unwilling to let them come altogether under the mercy of the cat, I have them in a small cage which destroys the tail as fast as it grows: if they succeed in thriving with me, I will send them home alive in the spring; they will feed well on the intestines of fowls or anything of that nature, and I have no doubt of their living in Europe by care."

* This is an important fact; the same manner of taking the food is practised by the Toucans.

CERYLE ALCYON, *Linn.* N.

This is properly a North American species, according to Sir J. Richardson's tables, reaching as far north on the Saskachewan during summer as the 53° and 54°, and from 600 to 1000 miles from the sea. The winter quarters are there also stated to be the Southern States, Mexico, California within the tropics, and even the West Indian Islands, as Mr. Swainson possessed specimens from St. Vincent's sent by the Rev. Lansdowne Guilding. We have also received specimens from Jamaica, but these islands may be near the limits of their range in summer; in Tobago at least they are not common; the note of our correspondent being, "migratory, but cannot say as to the period of their arrival or departure; seldom seen; this is the second within the last two years, one in February, this in October."

CERYLE AMERICANA, *Gmel.* S.

"Tobago Kingfishers—feed upon fish, and are to be found in great abundance on the banks of our fresh rivulets."

GALBULA LEPTURA, *Swain.* S.

We refer the Tobago birds to the *G. leptura*, Sw. (Animals in Menageries, No. 141), which seems to have been described from specimens brought from Guiana by Sir R. Schomburgk. "Jackamar of natives: eyes dull red; feeds on Cantharides flies; builds in marl banks like the mot-mot, without any preparation except digging a hole or entrance an inch and a half in diameter; the distance of the eggs from the entrance about 18 inches; they are three in number, pure white, and nearly circular, differing only one-tenth in longitudinal diameter."

The forms which come next in our list are very numerous, and from the generally dull colours of their plumage and their retired habits very little is yet known of them, while the species remitted from time to time to Europe are extremely difficult to make out or reconcile with previous descriptions. Where we have had any doubt it is marked, and to those to which a new provisional name has been applied, a description and measurements are added; our correspondent will do well to give as much attention as he can to these curious and interesting forms of the *Certhiadæ*.

SCLERURUS ALBOGULARIS, *Swain.*? S.

We have no note of this species, and have only received two specimens ♂ ♀.

SYNALLAXIS TERRESTRIS, *Jard.* S.

"Resident; eyes dark orange and slightly freckled; feeds on

insects, found either on the ground or very near it." Length 6 inches, of wing $2\frac{1}{12}$; both sexes nearly equal in size. ♂ above yellowish brown; shoulders, greater and lesser wing-covers, outer webs of the scapulars and quills sienna-brown; tail reddish umber-brown. Below wood-brown, tinted with reddish on the breast and sides of the neck, the feathers of the whole tipped and edged with a deeper shade, giving to these parts an indistinct marking; chin and throat white with the base of the feathers black. ♀ colours slightly duller, the throat and fore part of the neck pale wood-brown, the feathers edged with grayish brown.

Dendrocincla turdina, *Licht.*? s.

We have compared the Tobago birds with specimens of what we have named *D. turdina* from other localities: in the former there is a little more rufous on the wings and tail, the tint of the plumage generally is clearer, and the bill is less powerful and less dilated at the base, but with these exceptions, there is nothing to separate the two*. "Feeds on grasshoppers, winged and other insects; tongue slightly bifid; legs light lead-colour: although the tail resembles the Woodpeckers the os hyoides is entirely different from that tribe."

Dendrocolaptes susurrans, *Jard.* s.

"Resident; eyes dark brown. This species seldom ascends trees to any great height, but generally proceeds from one tree to another, running up ten or twelve yards examining the crevices; uttering occasionally a shrill purring note peculiar to the species, easier distinguished than described; I found in the stomach some parts of large insects resembling wings, probably of grasshoppers." Among the specimens received, the difference in length, with one exception, amounts to about 1 inch, that of the wing being similar in all. Bill nearly straight, slightly curving towards the point; mandible umber-brown; maxilla paler; crown, cheeks and back of the head umber-brown, centre of each feather having an oval ochraceous spot; nape and back yellowish brown, the feathers on the nape and upper part of the back having the central ochraceous spots elongated and narrower as they reach the back, where they gradually disappear, each being surrounded by a narrow umber-brown line; rump, wings and tail dull reddish orange; throat yellowish white, remaining under parts yellowish brown, on the throat and breast having each feather marked in the centre with an oval yellowish white spot surrounded with a darker line; these markings gradually grow more and more in-

* The Tobago bird does not agree with Lichtenstein's character, "capite striolato."

distinct towards the lower part of the breast, where they are lost. Entire length from $9\frac{8}{12}$ to $8\frac{8}{12}$ inches; of bill about $1\frac{6}{12}$; of wing in all $4\frac{5}{12}$. One specimen 8; wing $3\frac{5}{12}$.

Sittasomus griseus, *Jard.* s.

"Resident; this bird is said to be hitherto entirely unknown in Tobago, hence it has no provincial name, but finding it to correspond exactly with Wilson's Brown Creeper so far as regards manners, I have applied that name to it." Above grayish oil-green; scapulars, rump and tail brownish orange. Below grayish oil-green, under wing-covers, base of the secondaries and part of the inner webs of the last quills yellowish white. Lengths of three specimens 7, $6\frac{6}{12}$, $5\frac{9}{12}$ inches; wing of two first $3\frac{5}{12}$; of last $3\frac{1}{12}$.

Thryothorus striolatus, *Swain.* (Wood Wren, or Gray-throat Wood Wren.) s.

"This species has a lively and powerful whistle, pronounced distinctly and with great emphasis, running over the notes in a shrill voice often repeated. Feeds on spiders, &c. This bird long remained unobserved by me; my attention was arrested by his sprightly notes, and I am inclined to think that frequent excursions in the woods about the season of incubation might be the means of eliciting some new species, which at other seasons remain mute and unobserved from the extreme height of the trees as well as the thick foliage and impenetrable nature of our underwoods."

To the last three or four birds the name "Woodpecker" or "Creeper" seems commonly applied in Tobago, though they are known to be a form quite different from the true Woodpeckers to be after noticed.

Troglodytes furva, *Vieill.* (God Almighty Bird or Wren.) s.

"This is a beautiful warbler; so domestic, that it builds in general either inside our dwelling-houses or somewhere in the vicinity, makes a coarse nest lined inside with feathers and lays four eggs. Remarkable for its cleanly habits—carries all the excrements of its young out of doors; feeds upon insects, and is by nature all the year what the European robin is by necessity in winter, making our houses its constant home. It darts with rapidity on the most venomous insects—a first attack separates the tail of the scorpion from the body, then both portions are carried in triumph to feed its young. I have often when writing been so annoyed with this little warbler pouring forth his song upon a chair-back within 10 feet of my desk as to be obliged to expel him from the house, which is not easily done, especially if they

have a nest. They have been known in some instances to occupy the same corner not only throughout the year, but during the life of the oldest inhabitant. I know not how often they build in the year, but the young have a very short time left the nest, when the work of relining it again commences, and it is generally during this time of incubation that the song is poured forth with all its sweetness." In a subsequent letter Mr. Kirk continues, "I mentioned in my supplementary letter of last year, that this little bird built generally in our houses; I have since found a nest in the very interior of the woods, and at the same time neglected to relate one very daring act of his in which I participated. One day my attention being arrested by the more than usual vociferations of this little bird quite adjacent to my window, on looking out I observed a pair of them fluttering and hovering over a small bush of grass in the garden; on stepping down stairs I observed a whip snake 4 or 5 feet long, hiding his head and drawing his body after him under the grass; on turning him out he was attacked right and left by these little warblers, striking him on the head and tail alternately as an opportunity offered, obliging him to take refuge wherever he could hide. They seemed to pay no attention to my presence, for on pressing his head to the ground they continued to nip his tail with their bills within 3 feet of me. After I despatched him they retired to an adjoining fence and poured forth a thousand thanks in an ecstasy of joy."

SYLVICOLA ÆSTIVA. (Canary or Siskin.) N.

"Migratory; time of arrival and departure not ascertained, but they are to be found in February, March and April. Feed upon small ants which they pick from the blossoms of trees, especially that of the 'Cog wood,' of which they appear particularly fond, and which is exactly the colour of the bird's belly when in good plumage; they warble very prettily at times, are very unstaid, and appear always pursuing each other." We receive this also from Jamaica.

SYLVICOLA PARUS. N.

A single specimen only has been received and without remark.

[To be continued.]

IX.—*A Supplement to "A Synopsis of the British Rubi."* No. 2. By CHARLES C. BABINGTON, M.A., F.L.S., F.G.S. &c.†

9*. *R. Grabowskii* (Weihe?); caule arcuato anguloso glabro, aculeis æqualibus valde declinatis deflexisve basi dilatatis, *foliis* quinato-digitatis planis *supra opacis* glabris *subtus cinereo-tomentosis*

† Read before the Botanical Society of Edinburgh, Jan. 14, 1847.

acute dentatis, *foliolo terminali cordato abrupte cuspidato infimis pedicellatis intermediis incumbentibus*, paniculæ compositæ inferne foliosæ ramis ascendentibus : rachi pilosa summa pedunculisque tomentosis, *fructibus pubescentibus.*

R. Grabowskii, *Weihe in Wimm. et Grab. Fl. Siles.* ii. 32 ?

R. nitidus ? var. rotundifolius, *Bloxam MSS. in Fasc. of Rubi.*

Stem arching, angular, furrowed when young, glabrous (young shoots slightly hairy), ultimately purple; prickles moderately numerous, rather short, yellow, from a broad red base, strongly declining or deflexed, nearly equal, confined to the angles of the stem. Leaves quinate-pedate; stipules almost linear; petioles and midribs with numerous strong much-hooked prickles; leaflets finely toothed: teeth pyramidal, glabrous opake and dark green above, ashy white and finely woolly with the veins rather yellow beneath; terminal leaflet broader than long, cordate below, abruptly cuspidate, sides regularly rounded; lateral similar but proportionably rather longer and almost exactly round; basal elliptical-ovate, rather unequal, overlapping the lateral leaflets, which themselves overlap the terminal leaflet.—Flowering shoot long, nearly glabrous; prickles numerous, rather slender, declining. Leaves nearly all ternate, ashy green beneath; petioles and midribs beneath with many short hooked purplish yellow prickles; leaflets like those of the barren stem, but the lateral ones lobed on the lower side; stipules very slender. Panicle narrow, compound, not setose, very prickly throughout: prickles slender declining or deflexed; rachis pilose below, becoming more hairy upwards, its summit and the peduncles and pedicels tomentose; about three lower branches axillary, short, racemose-corymbose, about six-flowered; ultra-axillary part compact, cylindrical, abrupt, branches short and corymbose; terminal flower subsessile; lower bracts leaf-like but inconspicuous, upper trifid hairy and tomentose. Sepals woolly, loosely reflexed from the oblong black pubescent fruit.

Near Cadeby, Leicestershire, *Rev. A. Bloxam.* August ?

Obs. 1. This plant agrees so nearly with the elaborate description in the 'Flora Silesiæ' that that work might perhaps be referred to without doubt. In the Silesian plant the panicle is described as "ampla, pyramidata, apice acuta, usque fere ad apicem foliosa," but it is not so in our plant. In that the under side of the veins of the leaves is said to altogether want any longer hairs—in our plant those veins are clothed with longer hairs.

Obs. 2. This is an interesting connecting link. The clothing of the panicle and of the young lateral branches from the barren shoot is that of *R. nitidus.* It differs from that species by its hooked prickles; very abrupt leaflets opake above and whitish

beneath, the lower and intermediate ones overlapping; and its woolly fruit. Its leaves much resemble those of that form of *R. discolor* named *R. abruptus* by Lindley, but that has silky barren and flowering shoots and rachis, and a very different panicle. Perhaps the most remarkable character of this plant is found in its woolly fruit, by which it is distinguished from all the allied species. The authors of the 'Flora Silesiæ' have not described the fruit of their plant. Arrhenius mentions a pubescent-fruited variety of *R. corylifolius*, but our present subject can scarcely be confounded with that species.

10. *R. discolor*, W. et N.

In place of the description of the varieties (Annals, xvii. 236) it is proposed to substitute the following.

α. discolor; caule strigoso-sericeo, aculeis declinatis deflexisve, foliolis marginem versus sæpissime decurvatis supra glabriusculis subtus albis tenuissime tomentosis, paniculæ racemosæ tomentosæ ramis decompositis.
R. discolor, *Rub. Germ.* 46. t. 20; *Arrhenius, Rub. Suec.* 32.
R. fruticosus, *Sm. Eng. Bot.* 715.

β. thyrsoideus (Bell Salt. !); caule subglabro, aculeis rectis, foliolis planis supra glabris subtus viridi-cano- vel candicanti-tomentosis, panicula elongata thyrsoidea tomentosa.
R. thyrsoideus (*Wimm.*), *Arrhen. Rub. Suec.* 28.
R. fruticosus, *Rub. Germ.* 24. t. 7.
R. discolor *var.* lividus, *Bloxam MSS. in Fasc. of Rubi.*

γ. macroacanthus (Bell Salt. !); caule sparsim patenteque piloso, aculeis validis pilosis rectiusculis paululumve deflexis, foliolis planis supra pilosis subtus pubescenti-canis mollibus, paniculæ pubescentis ramis racemosis paucifloris.
R. macroacanthos, *Rub. Germ.* 44. t. 18.

δ. argenteus (Bell Salt.); caule patente-piloso, aculeis rectis, foliolis planis subtus argenteo-cano-pubescentibus, paniculæ pubescentis ramis racemoso-compositis paucifloris.
R. argenteus, *Rub. Germ.* 45. t. 19.

Obs. 1. Since the publication of my former account of this species I have seen reason to modify my views concerning its varieties. I now think that Dr. Bell Salter is correct in referring tab. 7 of the 'Rub. Germ.' to the *R. thyrsoideus* of Arrhenius; his and my *var. β.* of this species. The former difference between us originated from none of my specimens of *R. thyrsoideus* having well-developed panicles. A plant given as *R. discolor* var. *lividus* in Bloxam's 'Fasciculus of Rubi' is what I consider as the true *R. thyrsoideus*.

Obs. 2. The former "Obs. 2" (Annals, xvii. 237) is not cor-

rect. I believe that the lower (axillary) branches of the panicle ascend in all the varieties, and the upper (ultra-axillary) branches usually spread at a considerable angle to the rachis. I am not well-acquainted with *var.* δ, having only one rather doubtful specimen; the character of it is therefore a compilation from books.

12*. *R. Balfourianus*; caule arcuato teretiusculo patenti-piloso, aculeis paulo inæqualibus tenuibus rectis vix declinatis, foliis quinatis subtus mollibus pallide viridibus, foliolo terminali cordato ovatove acuto, *infimis subsessilibus intermediis incumbentibus*, paniculæ corymboso-diffusæ tomentosæ setosæ bracteis foliaceis trifidis, *sepalis* ovato-lanceolatis tomentosis setosis *erecto-patentibus* apice foliaceis vel filiformi-attenuatis.

R. Balfourianus, *Bloxam MSS. in Fasc. of Rubi.*

Stem roundish, striated; pubescence of scattered patent hairs; prickles moderate, scattered, nearly equal, straight, very slightly declining, reddish yellow. Leaves large, quinate, dull green and pilose above, pale green soft and downy with the veins yellow beneath, crenate-serrate-apiculate; terminal leaflet cordate or ovate, acute, on a long stalk; lateral leaflets ovate, acute, shortly stalked; basal subsessile, ovate, overlapping the intermediate pair; general and partial petioles pilose, with few distant rather stout depressed yellow prickles; midribs similarly armed; stipules lanceolate, leaf-like, attenuated at both ends.—Flowering shoot with scattered hairs. Leaves ternate or quinate; leaflets ovate, pilose above, downy beneath. Panicle corymbose or diffuse, tomentose, pilose, setose; lower branches axillary, upper ones subtended by trifid leaf-like bracts. Flowers mostly on long stalks; terminal one shortly stalked or subsessile; sepals ovate-lanceolate, very broad, attenuated into a long leaf-like or setaceous point, often slightly trifid at the end like the uppermost bracts, downy on both sides, setose, brownish green, erect-patent when the hemispherical fruit is ripe.

Near Rugby, Warwickshire, *Rev. A. Bloxam.* August?

Obs. It is difficult to determine the position of this plant. Its stem, pubescence, and prickles place it near to *R. sylvaticus*, whilst its usually much more lax and diffuse panicle, and especially the erect or embracing calyx of the fruit seem to separate it widely from that species; in the latter point and in some others of less moment, it is nearly allied to *R. Borreri*, from which its barren stem abundantly distinguishes it. The lower leaflets also overlapping those of the intermediate pair distinguishes it from both of those species.

Named by Mr. Bloxam in honour of Professor John Hutton Balfour, M.D., of Edinburgh, and in paying this just compliment to my valued friend I fully concur with him.

19. *R. rudis*, Weihe.

ε. *denticulatus*; foliolo terminali quadrangulari-obovato cuspidato basi cordato late inepteque dentato: dentibus denticulatis.

Stem angular, striated; hairs very few; setæ and aciculi not many, short. Terminal leaflet with a somewhat square outline widening slightly upwards and then narrowing rapidly to a cuspidate termination, cordate below. Leaflets all stalked; margin with broad but very shallow and scarcely distinguishable teeth, fringed with small acute prominent denticulations; dark green and pilose above, pale yellowish green beneath. Panicle exactly like that of the typical *R. rudis*.

Loxley near Sheffield, *Rev. W. W. Newbould*.

Obs. This is a very curious variety, in which the coarse serratures of *R. rudis* are reduced in length but not in width, and are thus converted into very broad and very shallow teeth; the whole margin is also fringed with minute points or denticulations. It is very near in general character to *R. rudis β. Leightonii*, but differs in the above respects.

22. *R. fusco-ater*, Weihe.

δ. *subglaber*; caulis petiolorumque aculeis subæqualibus setisque paucis, aciculis brevibus pilisque paucissimis, foliis apiculato-dentatis supra glabris subtus tomentosis, foliolo terminali cordato cuspidato, paniculæ diffusæ tomentosæ pilis subnullis setis aciculisque brevibus aculeis elongatis.

Distinguished from all the other forms of *R. fusco-ater* by its almost total want of hairs on the panicle, and the nearly glabrous and more uniformly prickly stems. Its panicle is much divided and spreads in an irregular manner. It is the plant mentioned in the Synopsis as received from Mr. Coleman. Mr. Adamson's plant noticed in the same place is more nearly allied to the typical *R. fusco-ater*.

Mangrove Lane near Hertford, *Rev. W. H. Coleman*. On the canal bank between Claverton and the Dundas aqueduct near Bath.

X.—*The Birds of Calcutta, collected and described by* CARL J. SUNDEVALL*.

[Continued from vol. xviii. p. 461.]

69. *Gallus alector* var. *domestica*. Tame fowls are kept in great numbers by the Musselmans and Portuguese†. The Hin-

* Translated from the 'Physiographiska Sällskapets Tidskrift' by H. E. Strickland, M.A.

† The Portuguese who migrated thither in the time of Albuquerque settled in the country, and their descendants, who are now numerous in and around Calcutta, have become as black as negroes. The Hindoos in the lowlands have nearly the same colour.

doos also, who do not themselves kill or eat animals, rear poultry to sell to Europeans. These birds are similar to our own, and of as many varieties: possibly some have been brought thither from Europe. I often inquired whether any yellow or horn-like spots are seen on the neck-feathers of any variety, as in the wild *Gallus Sonnerati* of India, but nothing of the kind was detected, nor any cocks with a blue margined or undivided comb on the head, such as other wild species have. It is reported that wild poultry are found in the Sunderbunds, which is very probable, as *Gallus bankiva*, Temm., which is indubitably the origin of the domestic fowl, is said to occur in many parts of India.

70. *Perdix*. I was informed that partridges are found near Calcutta, and even that they are abundant; but as I never saw any, I cannot say what species was intended. They were said to resemble *P. cinerea*.

Wild pea-fowls (*Pavo cristatus*) are also said to occur in the uninhabited districts. I saw two which were said to be caught in the country, but nothing certain was learnt as to the place where they were taken, except that they were from "the jungles," and the same was the case with most of the wild animals which I saw in captivity; but whether the jungles around Calcutta or in Nepal or the Sunderbunds were intended, could not in general be decided. *Jungle* is an original Indian word which is now adopted in English to express a forest: it commonly implies the dense thickets of bamboos and bushes which prevail everywhere.

Pavo bicalcaratus, Linn., was also seen caged, and was said to be from jungles far up the country. Various other gallinaceous birds occurred tame or in confinement as rarities, e. g. *gold* and *silver pheasants* from China. Guinea-fowls (*Numida meleagris*) are kept in some places, as at the Government garden at Serampore, where some had lived and propagated for many years in company with a flock of Axis Deer, without any other superintendence than that of being prevented from escaping.

71. *Grus antigone*, L., Wagl. Syst. no. 10. Cinerea capite toto nudo, rubro, vertice cinereo.

(Indiv. vetus Martio.) Collum supra medium albidum, supremo breviter nudum, et ut caput rubrum. Iris rubra. Remiges posticæ parum laceræ, vix pendulæ. Altitudo euntis 5 ped. In hoc individuo rostrum et pedes fuscescentia, obscura; remiges et cauda saturate cinereæ.

I did not see in a wild state this elegant Crane, which closely resembles our common species, but is twice the size; it can erect itself to a height of full three ells from the ground. It is the largest in the genus, and is one of the birds which come nearest

to the Ostriches in size. I saw several of this species tamed, and especially I had an opportunity of observing accurately and closely one which was kept in the garden at Serampore, and which had been caught several years before near that town. These birds are said to appear rarely so low down, but further north they seem to occur in large flocks, probably however only in winter, for in summer they are found, according to Pallas, in the southern parts of Siberia. This Crane had as lively actions as our own in a tame state; it sprang, hopped, cast up straw and sticks and caught them again, as though some person was playing with it. The Bengalese name is *Saros*.

72. *Ibis macei*, Cuv. R. A.; Wagl. Syst.—I. leucon, *Temm. Pl. Col.* 481 (an Tant. melanocephalus? *Lath.*).

Alba, capite colloque nudis, nigris, remigibus (plerisque) totis albis; tarsis reticulatis, digito medio vix longioribus. ♀ adulta (initio Maii). Pure alba. Caput et collum cute duriori, nigerrimo tecta. Cutis plumata corporis pallide rubra; sed in plaga obtecta, ad latera pectoris, et in tota ala, subtus, usque ad digitos, sanguinea, subnuda. Iris nigricans. Rostrum et pedes nigri. Remiges primariæ albæ (in hoc individuo omnes immaculatæ); 3ª reliquis longior; 2ª brevior quam 4ᵗᵃ. Pennæ cubiti 5 ultimæ dilute cinereæ (nec nigræ), pogonio longissimo, laxo, pendulo fimbriatæ, et apicem alæ paullulum deflexo-superantes. Plumæ colli infimi, in lateribus subtusque, elongatæ, acutæ dependentes (collare infra partes nudas formantes, ut in *Vulturibus*). Longit. 26½ poll. Ala 322 millim., tarsus 88; digitus medius 68, cum ungue 82, cauda 130, rostrum e fronte 143.

Indiv. aliud, Mus. Stockh. (Patria incerta.) Simile præcedenti. Ala 316 mill., tarsus 90, digitus medius 72, cum ungue 86.

Indiv. e Java, Mus. Stockh. a prioribus tantum in his differt; remiges 1—3 apice nigro-marginatæ. Pennæ cubiti ultimæ vix laceræ, apice cinereæ. Collare caret plumis elongato-dependentibus. Ala 330 mill., tarsus et digitus ut proxime præcedens (verisimiliter junior).

Obs. Descriptio *Wagleri* citata differt "remige prima apice nigra." Icon *Temmincki* (loco cit.) bene convenit cum nostro individuo bengalensi; sed descriptio ad hanc figuram data paullo differt, et, ubi de plumis alæ ultimis agitur; cum individuo javano nuper descripto congruit.

This species of *Ibis* was first seen on the river bank in March near Sucsagor, N. of Calcutta, and afterwards in the beginning of May near Culpe, five or six miles further south near the capital. In both cases five birds were seen grouped together. They walked steadily about like storks, which they much resemble in their exterior. The flight and mode of rising is also like that of the Stork, though the neck is not carried straight, but somewhat curved in an opposite direction to the beak, yet not doubled like a heron's. The pure white colour and the large wings made

like a stork's with long bones, make the bird appear very large, although it but slightly exceeds our *Numenius arquata*. The specimen which I shot had nothing in the stomach but small crabs. This bird closely resembles *Ibis religiosa* which occurs in Central Africa, and is found embalmed in the Egyptian catacombs, although it seems not to inhabit Egypt at present. It is chiefly distinguished by the black tips to all the remiges, and by the pendulous, blackish, much-fringed feathers behind the wings.

73. *Ibis falcinellus*. Although this bird did not come into my hands in Bengal, nor have I seen any specimen from thence, I do not hesitate in citing it here. Three individuals were seen on March 23, near Sucsagor, at about 200 ells distance, which was near enough to distinguish the colours. They were pursued and were very shy.

74. *Ciconia alba*, L. (vix = *Mycteria asiatica*, Lath. ?). The Stork is one of the birds which occurs both in Sweden and Bengal: it is probably found in the latter country only at the season when it is wanting with us. In the tree-covered vicinity of Calcutta I only saw one, but some miles further north they occur in flocks on the plains: about sixty were counted in one of these flocks. This was a very unusual sight for a European, for the storks with us live, or at least fly, solitary; yet in our country they assemble in flocks at certain places of meeting, in order to migrate. There has been from time immemorial one of these meeting-places for storks on certain hills near my native place, Högestad in Southern Scania. These hills lie between Högestad and Baldringe on a dry heath, surrounded on two sides by marshes and peat-bogs, about 1000 paces from an open oak-wood, where storks have always built in numbers. After the storks in autumn have collected around in parties for some weeks, without keeping near the nests or roosting in them at night, one may see them some day in the middle of September coming from all quarters to the hills in question. The number gradually increases, so that many times more storks than breed in the district are soon assembled. They are supposed to come hither from a considerable part of Scania, perhaps from all the colonies which are sent out at intervals from the oak-wood above-mentioned. Two days thus elapse, during which the birds which have arrived chiefly remain quiet, each by itself, without seeking food, which however is to be found abundantly in the marsh close by; but the following morning they have all disappeared, and no stork is seen afterwards in the district, until they, after half a year's interval return more gradually to their homes from their distant wanderings. The natives say that they hold a council before they set out from the country. Many such meeting-places for storks are

found in Scania, near the woods which they inhabit. In the wood just mentioned they build close to each other in the oak-trees, and agree well together; but in other places they usually will not allow another bird in their vicinity, without a violent battle arising when they come near each other's nests.

The storks which I saw in Bengal had the beak and legs red as with us, but it occurred to me that the black between the beak and the eye in the males was somewhat broader.

75. *Ciconia dubia.*—Ardea dubia, *Gm.*; *Rafl. Sumatr.* Ardea argala, *Lath.* Ciconia marabu, *Temm. Pl. Col.* 330; *Wagl. Syst.* (De nomine vide infra.)

Cinerascens (absque nitore viridi), capite colloque nudis, jugulo inferius caruncula conica dependente.

Adulta: Corpore supra nigro-cinereo, subtus albo; collo pallide rubro, caruncula longiore. *Junior*, tota dilutius cinerascens. De ceteris, confer descr. Wagl. et Temm. Ala flexa long. 3 pedum.

This Stork, with the American *Ciconia mycteria* and the Condor, comes in size next to the Struthious birds. After it follows an African Stork, the above-described Indian Crane, the two Vultures of South Europe, the Swan, Albatros, &c.; our Eagles follow, and so on. *Ciconia dubia* is 12 feet between the tips of the wings, or near the size of the Condor, and 5 feet to the top of the head when it walks, which is not more than *Grus antigone*; but the body is larger. It is a prodigy of ugliness; gray, dirty, with the head and neck naked, reddish, thinly strewed with hair, which on the nape forms a ragged tuft; on the lower part of the neck is a loose fringe of feathers, over which there hangs from the throat a fleshy caruncle, much like that over the beak of a turkey-cock. The whole appearance indicates stupidity, especially when in hot weather it sits upon its heels with the tibiæ erect, and gasps with the heat. The beak is disproportionately thick, and so strong that it can cut off the arm from a corpse. Like the vultures in Bengal, this Stork lives chiefly on the putrid bodies which are cast up on the river banks, as I have often stated. The Hindoos burn their dead, and this is done as far as possible on the banks of the sacred river; but as a complete funeral pile costs more than the poorer people can afford for their dead relatives, these are commonly laid at ebb-tide close to the water's edge upon some straw, which is set fire to, in order to fulfill the ordinances of their religion, after which the slightly scorched body is carried off by the flood-tide to drift about until it lodges by chance upon the shore, where predacious animals take charge of its burial. By day the vultures, crows, and especially this species of Stork, contribute to the destruction of the corpse, and by night troops of jackals arrive to complete the work; dogs also often partake in the feast.

The species in question is called in Bengal *Hargila* or *Hargill*, or *Gorur*. The Europeans sometimes call it *Eagle* or *Pelican*, but commonly *Adjutant*, in consequence of this bird being nowhere so abundant as at Fort William near Calcutta, and on the roof of the Government-house in the town, where often twenty or thirty collect in the evening to pass the night. The Hindoos regard them as especially sacred, and the English government has for their protection imposed a fine of sixteen rupees for the killing of one. They have even become so tame that at Fort William I often got within fifteen ells of them, and the inhabitants, whom they are more accustomed to see, can go close to them without their moving. I believe that they would make resistance if any one were to attack them.

The flight of the *Hargill* is remarkably steady and elegant, like that of the Vulture; in large circles with the wings perfectly still. One often sees them gradually ascend in spiral circles to such a height that they can hardly be perceived as fine specks; by the angle which they subtended I estimated the perpendicular height at a quarter of a Swedish mile [one and a half English mile]. They remain near Calcutta all the year, and are rather rare at some miles' distance from the town.

Obs. A nearly allied species is found in Africa, which is somewhat less, and greenish above. It was first described by Temminck and well figured in Pl. Col. 301. Under the tail of both these species are found the elegant curled feathers which are used as ornaments under the name of Marabu's feathers. Temminck calls the Indian bird *Ciconia marabu* and the African *C. argala*, but he has here confounded these names. *Argala* was derived by Latham from the Indian *Hargila*, and unquestionably applies only to the Indian species. *Marabu* on the other hand is a name introduced from Africa, and can least of all be applied to an Indian species which had two names already. The word *Marabun*, or in common parlance *Marabu*, means, according to the Arabic dictionary, an assembler of the people, and is used in Barbary for the priests of the Bedouins, who it seems use these feathers as marks of distinction; whence in Europe they have got the name of *Marabu's feathers*. Now that this confusion of names has once occurred, it can scarcely be corrected in any other way than by adopting entirely fresh names; so that it is best to retain for the Asiatic species the older though ill-adapted specific name of Gmelin, *C. dubia*, and for the African one to adopt a new one, viz. *C. vetula*.

76. *Ardea nycticorax*, L., Wagl. Syst. no. 31. Plumis colli elongatis, tibia brevius nuda. Rostrum crassum, capite paullo longius. *Adulta*: alba, capillitio dorsoque æneo-nigris, alis, dorso posteriore obtecto, caudaque canis.

♀ (d. 28 Febr.). Occiput caret pennis longis albis. Plumæ dorsi anterioris viridi-nitentes, laceræ longæ : caudam attingentes. Supercilia et margo frontis alba. Collum postice leviter canescens. Rostrum apice fuscum, basi, cum loris et orbitis olivaceo-flavescens. Pedes virescenti-flavi. Iris sanguinea. Rostrum e fronte 70 millim. Altit. 22. Ala 272, tarsus 65, digitus medius 64, cum ungue 76.

This single specimen was procured from the Danish merchant Berg at Serampore, the same day that he had shot it near a small tank. I did not see this species living myself. It was considered rare, and was unknown to Berg, who was a keen sportsman. The stomach was empty, but smelt strongly of fish. *Ardea nycticorax* is one of the birds which is found all over the globe, in the entire torrid zone and in a considerable part of the temperate ones.

77. *Ardea scapularis,* Ill., Licht.; Wagl. Syst. no. 35. Plumis colli elongatis, tibia brevissime nuda, rostro capite longiore. *Adulta* cinerea; alis virescentibus, albo-marginatis. Capillitio æneo-nigro, crista dependente ; dorsi plumis longis, lanceolatis, obscure cinereis, virescenti nitidis, rhachide albida.

♀ (d. 20 Febr.—adulta). Corpus cinereum. Collum totum cum jugulo immaculato, cinereum, unicolor ; gula alba. Capitis latera cinerea, macula oblonga atra pone angulum oris, et vitta alba sub eodem. Rostrum et facies olivacea, maxilla inferiori et orbita flavidis. Pedes (in siccata) obscure rubicundi. Rostrum e fronte 65 mill., cum cranio 115. Ala 170, cauda 60, tibia nuda 12, tarsus 42, digitus medius 40, cum ungue 48. Differt ab indiv. americanis, quæ vidi, et a descriptione Wagleri jugulo non rufo maculato, magnitudine paullo majori, et rostro crassiori.

This small Heron, which is one of the least in the genus, not much larger than a *double snipe,* was only seen twice, at some tanks near Serampore. Like the larger species it is lazy, but shy and wary, and often perches in trees. The specimen obtained had the stomach empty, and smelling strongly of fish. The same species occurs also in South America*.

78. *Ardea speciosa,* Horsf., Wagl. Syst. no. 25. Plumis colli elongatis, tibia brevius nuda. Rostrum tenue, capite longius. Alba, capite lævi dorsoque plumis laceris, prolixis, obscuris.

♂ ♀ (junior ?) Febr. Martio. Corpus alæ et cauda alba, capite colloque plumis testaceis, late fusco-marginatis. Gula alba. Plumæ dorsi antici laceræ; magnæ, fusco-griseæ. Scapulares ejusdem coloris, striola media albida. Plumæ immixtæ, sericeo laceræ, fusco-purpurascentes. Plumæ occipitis nullæ elongatæ. Iris flavissima. Rostrum apice nigrum, basi et facie nuda flavescentibus. Pedes fuscescentes. Rostrum e fronte 62 millim., tarsus 53, digitus medius 53, cum ungue 62, ala 220.

* This is incorrect, the American species being distinct.—H. E. S.

Ardea speciosa is the commonest of the Bengalese Herons. It is seen everywhere near tanks and on the banks of the river, even among houses and at Serampore. It was said to build in trees, and is stationary the whole year. Like all the Herons it flies with the neck doubly curved. When the large white wings are expanded, but few of the dark feathers above the body are seen, so that the bird seems wholly white, but when it walks it appears dark gray. A male which was shot had the stomach filled with grasshoppers; in the female were found both grasshoppers and remains of fish. The Bengalese name is *Bogg* or *Khanni bogg*, which name however I often heard applied to the other species of Heron, both greater and less, white and coloured.

79. *Ardea russata*, Wagl. no. 12. Plumis colli brevibus, tibia longius nuda. Rostrum capite parum longius. *Junior* tota alba.

♀ (in fine Martii). Tota alba immaculata, occipite non cristato. Iris flava. Rostrum totum et facies nuda flava. Pedes fuscescentes, tarso superne parteque nuda tibiæ flavescentibus. *Unguis* medius validior, *usque ad apicem pectinatus*. Longit. 18 poll., rostrum e fronte 62 mill., ala 240, tarsus 87, digitus medius 57, cum ungue 75. Plumæ occipitis breves, simplices; pectoris vix elongato-pendulæ.

This small white Heron was seen rather less frequently than the last species during all the time I remained in Bengal. Among the many which I saw from February to April, none were observed with the isabella-coloured back, neck and head, as the old birds are described, which is perhaps owing to the old ones being more wary, so that I did not approach them near enough to distinguish the colour. The only one which I shot had been eating grasshoppers and water-larvæ, but no traces of fish were found in its stomach. This, like the other Herons with a small neck and long legs, is often seen walking about with outstretched neck. Those species which I have seen with long neck-feathers and shorter feet have been more sedentary; they conceal themselves and crouch, so that they are not seen until they fly up.

80. *Ardea garzetta*, Wagl. Syst. no. 10. Plumis colli brevibus, tibia longe nuda. Rostrum tenue, capite longius. Tota alba, pedibus nigris, tarso inferius digitisque viridi-flavis.

Senior (initio Maii). Iris flava. Rostrum et facies nuda nigra, orbita flavescente. Occiput et pectus plumis elongatis, pendulis, lacero-acutis. Plumæ dorsi speciosæ, raro pectinatæ, paucæ, vix caudam attingentes. Ungues breviores: medius 12 millim., pectine, ut in plerisque *Ardeis*, ante apicem abrupte terminato. Priori dimidio major.

Although this species was not rare, I only procured one specimen, which from various interruptions was not preserved, so that I cannot give the dimensions. It was often seen walking

with long steps on the river bank, and frequently perched in trees. Their white colour makes these species appear much larger than they really are. On the backs of this and two other species grow the highly-prized Egret-feathers. *Ardea garzetta* is also found in South Europe.

81. *Ardea cinerea*? Three or four times I saw (in the end of March and the end of April) a species which could hardly be anything else than our common gray Heron; I think I cannot be mistaken, although the bird each time arose at the distance of 200 or 300 ells. As *Ardea cinerea* is found in Europe and Africa, and is recorded to occur in Java and the Philippine Islands, it is not likely to be wanting in the intermediate country of India.

[To be continued.]

XI.—*Description of a new species of the genus* Actias *of Hübner, from Northern India.* By Edward Doubleday, Assistant in the Zoological Department of the British Museum, F.L.S. &c.

[With a Plate.]

Ac. Mænas. Alis omnibus pallide viridi-flavis, marginibus externis rufescentibus, anticis costa ferruginea, cinereo lavata; lunula magna discoidali fascia transversa baseos, alteraque postica indistincta valde undata rufescentibus; posticis caudatis, lunula discoidali parva; fascia pone medium flexuosa, obsoleta, rufescente. ♀. Exp. alar. 6½ unc. vel 165 mill.; caudæ long. 3½ unc. vel 90 mill. Pl. VII. fig. 1.

Hab. Silhet.

Anterior wings pale greenish yellow, the costa, except at the apex, ferruginous, sprinkled with cinereous; outer margin rufescent: near the base a transverse narrow band of the same colour, and beyond the middle a not very distinct flexuous streak: a large lunule at the end of the cell connected with the costal vitta, of the same colour with this at its origin, then much paler externally, nearly black internally, marked with a very delicate white line. Posterior wings of the same colour as the anterior, tailed, the tails very long, wrinkled at the extremity, sprinkled with ferruginous from the base nearly to the middle, the outer margin of the wing and of the basal half of the tail ferruginous; disc with a small black lunule divided by a white line resting on a faint cloud, darkest on the inner side: between this and the margin a very obsolete waved striga.

Below, the anterior wings want the basal striga, the costa is paler, the lunule wants the black, and the flexuous band is more distinct, as it also is on the posterior wings.

Head and antennæ pale.

Thorax greenish yellow, the front part broadly ferruginous, sprinkled with cinereous; legs vinous red, with pale spots.

Abdomen pale greenish yellow.

In the collections of the British Museum and W. W. Saunders, Esq.

This fine insect is easily distinguished from *Act. Selene* by its peculiar greenish yellow colour, the flexuous external striga, the want of the white band on the prothorax, the great length of the tails, and the more rounded anterior wings.

XII.—*Notices of new or rare British Animals observed during Cruises in* 1845 *and* 1846. By ROBERT M'ANDREW, Esq. and Professor EDWARD FORBES*.

[With a Plate.]

I. *Species of Testaceous Mollusca, new or new to Britain, from the seas around the Zetland islands.*

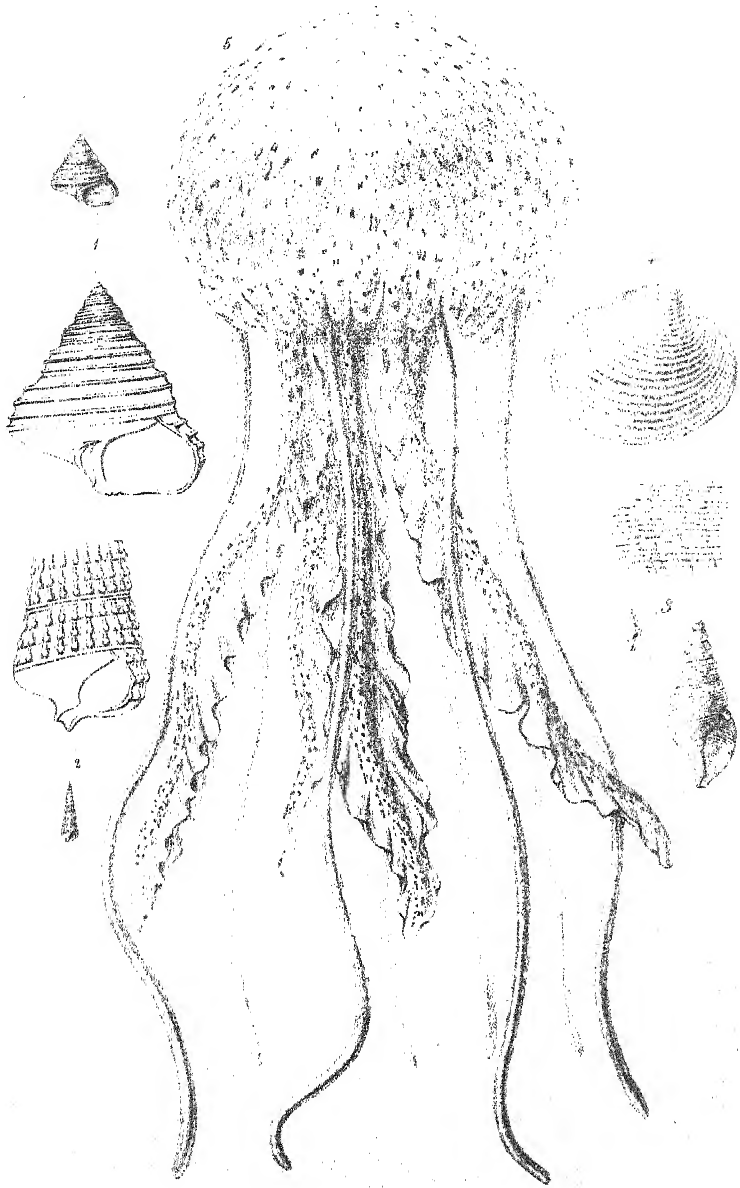
1. *Trochus formosus*, sp. nov. T. testa pyramidata, anfractibus 7, planis, nitidis, albis, spiraliter costatis, costis in ultimo anfractu sex, costa superiori crenulata; basi imperforata, in medio lævi, prope columellam sulcis tribus cincta; apertura quadrangulari. Animal album, oculis nigris.—Breadth at base $\frac{1}{2}$ an inch; height the same. Pl. IX. fig. 1.

This beautiful *Trochus* resembles *T. ziziphinus* in form and habit. The whorls are slightly convex, smooth, shining, white, and not covered by an epidermis. The body-whorl is encircled by six spiral ribs, the uppermost crenate, the next fine and smooth, the third and fourth thick and distant, the two lowermost close and fine. The upper whorls are encircled by three spiral ridges, those of the apex all crenate. The whorls are seven. The base is imperforate, slightly convex, smooth in the centre, with three spiral furrows round the columella and one round the margin. The mouth is quadrangular.

The animal is entirely white, except its eyes, which are black. It has long, linear, cirrhated tentacula. The eyes are borne on sus-tentacula at their outer bases. The capital lobes are partially developed and abbreviated. The lateral lobes are plain, and the sides furnished with six simple long cirrhi, which are usually carried closely appressed to the shell. The operculum is very pale.

The only British shell with which this *Trochus* could be confounded, is the variety *Lyonsii* of *T. ziziphinus*. But indepen-

* Communicated to the Natural History Section of the British Association at the Southampton Meeting, September 1846.



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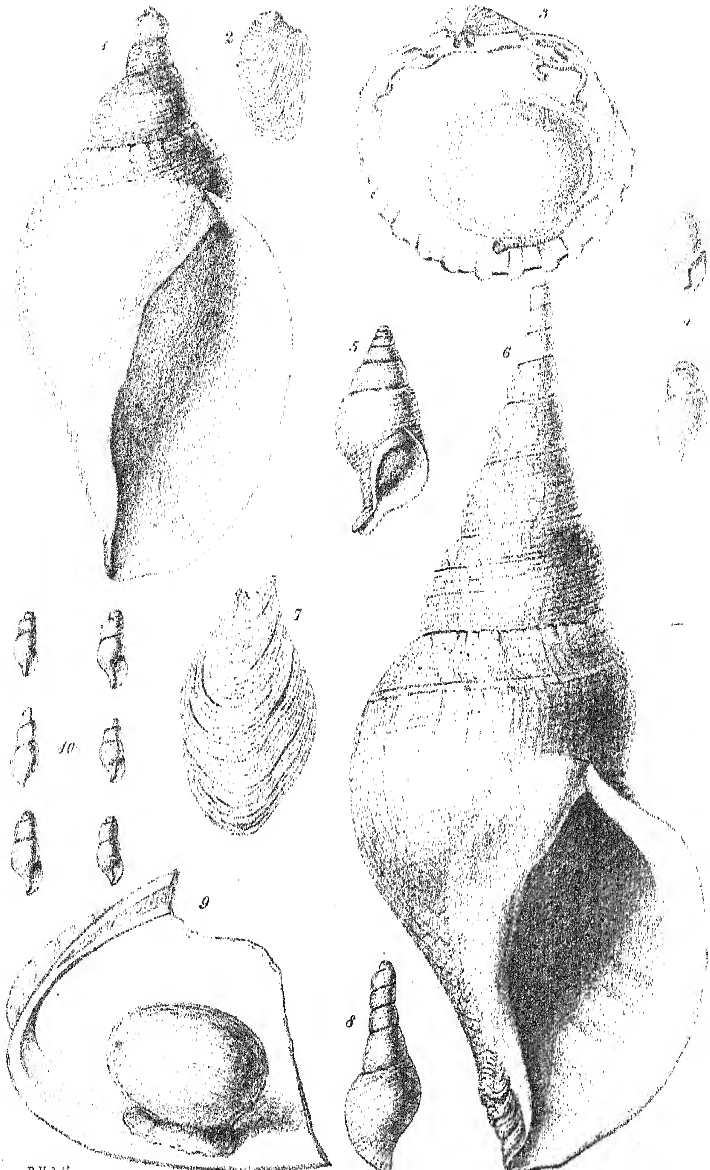
J.D.C.S. lith



R.H. del.t J.D.C.S. lith.

dent of the characters of the shell, the animals are very distinct; those of *Lyonsii* being highly coloured, like the normal form of *T. ziziphinus,* whilst *T. formosus* is perfectly white.

We dredged it adhering to large stones in fifty fathoms on the Ling Bank, forty miles to the westward of the mainland of Zetland, and afterwards nearly half-way between Fair Island and Fitful Head *.

2. *Margarita undulata,* var. *trochiformis.*

With some doubt we refer to the above species of Sowerby and variety of Moller (Index Molluscorum Grœnlandiæ) a *Margarita,* of which we dredged a single specimen near Lerwick. Whilst it exactly agrees with Moller's description, the specimen does not so well accord with any of the examples of *Margarita undulata* in British collections. It is small and probably not full-grown ($\frac{5}{25}$ breadth, $\frac{3}{25}$ height), and in colour and habit presents a striking resemblance to *Trochus tumidus,* but is easily distinguished by its rounded whorls and circular aperture.

3. *Cerithium nitidum,* sp. nov. C. testa subulata, alba, anfractibus 12, planis, spiraliter longitudinaliterque costatis; costis spiralibus tribus, fortibus, granuloso-decussatis; basi lævi, margine incrassato lævi; apertura quadrangulari, cauda brevi, lata, contorta.—Length $\frac{4}{10}$ths of an inch; maximum breadth $\frac{1}{12}$th of an inch. Pl. IX. fig. 2.

A very beautiful, slender but rather strong shell, having twelve whorls, which are nearly flat, and ornamented by three strong spiral ridges, decussated and granulated by numerous longitudinal ribs. On the last whorl there is an additional smooth ridge, forming the margin. The base is smooth. The mouth is quadrangular, with a short and rather wide but equal canal, twisted suddenly to the left.

Three specimens were dredged in the same localities with the *Trochus formosus.*

4. *Pleurotoma brachystomum,* Philippi, Enum. Moll. Sci. vol. ii. p. 169. t. 26. f. 10.

Of this pretty little *Pleurotoma* we dredged a specimen between Fair Island and Fitful Head in fifty fathoms. It has been taken by Mr. Jeffreys in the Hebrides.

5. *Fusus albus,* Jeffreys, MSS. F. testa minuta, lanceolata, pellucida, alba, anfractibus 5, convexis, ultimo maximo, omnibus spi-

* I have recently seen a specimen in the collection of Lieut. Thomas, R.N., who dredged it in a similar locality near Orkney. In that gentleman's collection is also the rare *Buccinum lineatum,* dredged quite fresh in thirty-five fathoms off the Staples; thus fixing with certainty the indigenousness of one of our most doubtful species.—E. F.

raliter crenato-striatis.—Length $\frac{3}{10}$ths of an inch; breadth $\frac{1}{10}$th of an inch. Pl. IX. fig. 3.

Exactly resembling a *Fusus corneus* in miniature, but evidently a full-grown shell, and well-characterized by its peculiar sculpture. No described species of *Fusus* can be confounded with it. We dredged it in fifty fathoms between Fair Isle and Fitful Head. On showing the specimen to Mr. Jeffreys, he recognized it as the *F. albus* of his manuscripts*.

6. *Astarte crebricostata*, sp. nov. Pl. IX. fig. 4.

We have applied this name provisionally to a remarkable *Astarte* of which several single valves, not very fresh, were dredged up on the west coast of Zetland. They evidently belong to a species very distinct from any European form with which we are acquainted. These valves are ovate, oblique, very depressed, with numerous (thirty), very prominent, narrow, elevated, regular, transverse ridges which become obsolete anteriorly, where they are interspersed by slightly oblique striæ. The margin is crenate. The largest valve measures 1 inch $\frac{2}{10}$ths in length and the same across.

7. *Astarte borealis.*

We dredged in fifty fathoms water on the Ling Bank off the west coast of Zetland a valve of this well-known species, so fresh that we cannot doubt that it is a living inhabitant of our northern seas.

[To be continued.]

XIII.—Drafts for a Fauna Indica. By Ed. Blyth, Curator of the Asiatic Society's Museum, &c. &c.†

[Continued from p. 53.]

Subfam. Gourinæ, *Ground Pigeons.*

The great series of ground pigeons and ground doves presents a marked gradation in form and character from genera allied (excepting in the form of the feet) to the *Carpophagæ* and *Ptilinopodes* of the preceding subfamily, to others which exhibit a nearer relationship to the species of the next subfamily. The size also varies remarkably, as both the largest and smallest pigeons known are comprised in this group; some attaining the magnitude of a hen-turkey, while others are scarcely bigger than a sparrow. These birds are of a shorter, more full, and grouse-like figure than that of other pigeons, having the wings more or

* Lieut. Thomas, R.N., has lately dredged it near the Orkneys.

† From the Journal of the Asiatic Society of Bengal, no. 169.

less rounded, and even bowed or hollowed in some instances; the tarsi comparatively elongated, and the toes long and adapted for ground habits. Some even much resemble partridges in their mode of life; but even these, for the most part, prefer the cover of low brush-wood (as do also many partridges), the haunts of different species varying; and other genera are completely sylvan in their abode, feeding on the ground, more especially on fallen fruits and berries. Such are the magnificent Gouras, or great crowned pigeons (*Goura coronata* and *G. Stoursii*) of the Moluccas and New Guinea, which in their plumage and colouring approximate *Treron cantillans* and *Carpophaga insignis*; and the elegant hackled ground pigeons (*Calœnas*), one of which (*C. nicobaricus*) abounds in the forests of the Malay peninsula, and in the Nicobar, Andaman and Cocos isles, thus almost verging on the eastern boundary of the territory whose fauna we here treat of. The general resemblance of this bird to *Ptilinopus* is striking in the living specimens of both; and from what I have observed of it in confinement, I have great reason to doubt the current statement that it ever lays more than two eggs, the number so usual in the pigeon family: indeed I think there is present reason to be sceptical of the statements that any pigeon lays more than that number; though it is certain that several of the *Gourinæ* are clad with down at an early age, and follow their parents soon after they are hatched. The only Indian species is among the least characteristic of the tribe, so much so, that it requires some knowledge of its various Australian affines to comprehend its classification in the present group. It ranks under

Chalcophaps, Gould (apparently a sylvan subgenus of *Phaps*, Selby, exemplified by the common Bronze-wing of Australia).

Ch. indica: *Columba indica*, Linn.: *C. pileata*, Scopoli: *C. javanica* (?), *cyanocephala* et *albicapilla*, Gmelin: *C. cyanopileata* et *griseocapilla*, Bonnaterre: *C. superciliaris*, Wagler. (*Rám-G'hoogoo* and *R'háj-G'hoogoo*, Bengal; *Gyo-ngyo*, Arracan.) Back and wings emerald-green, glossed with aureous; the feathers distinct and scale-like; neck, breast and under-parts vinaceous-brown, paler below, and of a duller hue in the female; two broad dusky bars alternating with grayish-white on the rump; tail dusky in the male, its outermost and penultimate feathers whitish-gray, with black subterminal band; primaries dusky; forehead of the male white, passing as a supercilium over the eye; the crown of the head ash-gray; a white bar near the angle of the wing; and lower tail-coverts ashy, the longest brown-black; inside of the wings reddish cinnamon-brown. The female has a grayish-white forehead much less developed than in the other sex, and a narrow whitish supercilium; crown of the head rufescent; no white bar at the shoulder of the wing; the tail

tinged with ferruginous; and the neck and under-parts are browner than in the male. Irides dark; bare skin around the eyes deep purplish-carneous, as are also the legs; and the beak is bright coral-red, except towards the nostrils, where somewhat dusky. Length $10\frac{1}{4}$ inches by $17\frac{1}{2}$; and of wing $5\frac{1}{2}$ inches to $5\frac{3}{4}$.

This beautiful ground-dove is common in thick jungly situations, and especially among dense bamboos throughout the country; and it is equally abundant in the Malayan Archipelago. A writer before-cited remarks,—"The rapidity of flight it exhibits exceeds that of any bird I am acquainted with, except perhaps the brief decisive swoop of some of the smaller *Falconidæ*: as in the progress of the latter there is no apparent motion of the wings, but gliding along a few feet from the ground, diverging or rising just sufficiently to clear intervening obstacles, the ground-dove skims with an arrow-like swiftness, and is come and gone in an instant, scarcely giving the eye time to detect what has crossed the field of vision. When settled on the ground, however, it shows no unusual degree of fear, and may be approached near enough to notice its motions and brilliancy of colouring. Bare spots about the roots of large trees, particularly of the tamarind, appear to be favourite resorts; and a pair will be occasionally found sunning themselves, arranging their plumage and scraping up the earth, and beating up the dust with expanded wings, after the manner of the *Rasores* upon an old *b'heetah*—the artificially raised mound of a deserted village. They soon become reconciled to confinement; and the voice is plaintive and monotonous like an oft-repeated low tone on a distant flute*." The nest of this species I have never seen, but am informed that it is built in low thorny trees and often in bamboo jungle: the eggs are two in number; and one taken from the oviduct (April 30th) measures just an inch long by three-quarters of an inch across, and is of a less pure white than those of ordinary pigeons and doves†.

There is a nearly allied species in Australia, the *Col. chrysochlora*, Wagler, which Mr. G. R. Gray conceives to be the true *Col. javanica* of Gmelin. One character by which it may always be readily distinguished, is the total absence of white on the fore-

* "*Columbidæ* of the Eastern Districts."—Bengal Sporting Review, No. 4, 1845.

† *Chalcophaps indicus* is common in the deep forests, always in the vicinity of streams, and generally upon the ground in the shelter of beds of reeds and rank grass. When flushed it takes a short but exceedingly rapid flight, alighting as abruptly with a sudden plunge into the herbage, so that it is a most difficult bird to shoot. Its favourite food consists of the seeds of the castor-oil plant.—T.

head of both sexes*. The rapidity of flight so remarkable in the Indian species, as compared with our other *Columbidæ*, is equally observable in other subgenera of *Phaps*, which might include even *Peristera* of Swainson†.

Subfam. Columbinæ.

This consists of the ordinary pigeons and doves, the characters and habits of which are familiar to all. They are mostly arboreal, though many of them feed much on the ground, chiefly on grain and oleaginous seeds; some of the species also nipping the young sprouts of vegetables. They fall into two principal and nearly allied series, those of the pigeons and the doves; the latter subdividing into several well-marked groups.

Genus Columba, Linn. (as restricted). Pigeons. (*Kubbooter*, H.; *Paira*, B.)

These are of comparatively large size, and generally more robust in make, with square or subquadrate tail. The Indian species fall into two subgenera, viz. rock pigeons and wood pigeons; the former exemplified by the common house pigeon, the latter by the common Cushat of Europe.

Rock Pigeons. In these the tarse is rather longer, and the toes are better adapted for walking on the ground. They rarely, if ever, perch on trees, except under peculiar circumstances, as when a dove-cot of domestic pigeons is placed near a tree, with large and conveniently shaped boughs, in which case the pigeons will commonly resort to the latter to sit and roost, but never to form their nests. In the wild state it is probable that they never perch at all, retiring to roost and nestle in caverns and small hollows of rocks or sea-cliffs, in the absence of which they select buildings that offer suitable recesses, breeding in the capi-

* It is I think very doubtful whether *C. chrysochlora* be really distinct from *indica*. The absence of white on the forehead is probably due to the specimens being immature.—H. E. S.

† A curious pigeon, in the guise of a *Pterocles*, is figured among the drawings prepared under the superintendence of the late Sir Alexander Burnes and Dr. Lord, marked *Fahktuk* (i. e. *Facktah* or dove, *Hind.*) from Cabul, which should be sought for in the Scindian deserts. Total length about a foot, the wing $6\frac{1}{2}$ inches, and tail pointed and *Pterocles*-like, extending nearly 2 inches beyond the tips of the wings; tarsi and toes, which, though rudely drawn, would appear to be those of an ordinary pigeon, naked and of a pink colour. Bill dusky, being also apparently that of an ordinary pigeon, and rather slender. General colour light isabelline, with darker margins to the feathers of the mantle and wings; neck, breast and underparts plain, the breast rufescent, and the belly and lower tail-coverts whitish; the outer tail-feathers would appear to have black tips; irides crimson. Should this hereafter be verified and constitute (as seems probable) a new genus of *sand-doves*, having the habits of the Gangas or Sand-grouse, it might bear the name *Psammœnas Burnesii.*

tals of pillars and whatever other convenient nooks they find. Hence, when unmolested, these house pigeons soon become familiarized with man, and require little encouragement to merge into the domestic condition.

C. INTERMEDIA, Strickland, Ann. and Mag. N. H. 1844, p. 39: *C. œnas* of India, *auctorum*: *C. œnas*, var., from Tartary, Wagler. (*Jalalaya*, H.; *Parwa*, Mahr.; *Golah* of the pigeon dealers.) (INDIAN ROCK PIGEON.) The common wild blue pigeon of India is most closely allied to the European *C. livia*, but is of rather a deeper slaty-gray, with invariably a deep ash-coloured rump; whereas *C. livia* has as constantly a pure white rump: there appears to be no other distinction between them, unless it be that the play of colours on the neck is finer in the Indian bird. The same difference in the colour of the rump is observable in the domestic pigeons of the two countries, whenever these tend to assume the normal colouring; for the tame Indian pigeons are as clearly derived from the wild *C. intermedia* as those of Europe are from *C. livia*.

Colour slaty-gray, darker on the head, breast, upper and lower tail-coverts and tail, which last has a blackish terminal band not well-defined; nuchal feathers divergent at their tips, and brightly glossed with changeable green and reddish-purple; two black bars on the wing*; the primaries tinged with brownish, and the outer-

* In some specimens, particularly among the semi-domestic, slight dusky streaks occur on the shafts of the lesser wing-coverts, which, in the latter, are often much more developed, spreading across the feathers and spotting the whole wing; such birds much resembling (except in the rump not being white) a race of wild pigeons that are abundantly brought at times to the London markets—all of them shot birds; but the latter have not, in addition, the two black bands on the wing well-defined, as seems to be regularly the case with this variety of *C. intermedia*. Moreover, in the English bird, the spotting of the lesser wing-coverts does not occur on the shafts of the feathers, but partly margins each web, excepting near the edge of the wing, where the feathers are unspotted. I suspect that the wild rock pigeons of the south of England are mostly of the kind alluded to, which may be designated *C. affinis*; while those of North Britain, and it would seem of Europe generally, are true *C. livia*.

Here, again, we have three closely-allied species, analogous to the three yellow-footed Hurrials, *Treron viridifrons*, *Tr. phœnicoptera*, and *Tr. chlorigaster*; and if they are to be regarded as mere varieties of the same, what limits can be assigned to the further variation of wild species? *Col. leuconota* is but a step more removed, and I doubt not would equally merge and blend with the others in a state of domesticity. Equally allied are—*Treron sphenura* and *Tr. cantillans*; *Tr. apicauda* and *Tr. oxyura*; and if we grant also some variation of size, we have *Tr. bicincta* and *Tr. vernans*; *Tr. malabarica* and *Tr. chloroptera*; *Turtur chinensis* and *T. suratensis*; *T. meena* and *T. auritus*, &c. &c., which might be regarded as local varieties of the same, and we might thus go on reducing species *ad infinitum* with no useful definite result, but to the utter confusion of all discriminative classification. However closely races may resemble, if they present absolute and constant

most tail-feather having its external web gradually more albescent to the base. Irides brownish-orange, the lids bluish-white; bill black, with a white mealiness at the tumid base of its upper mandible; and legs reddish-pink. Length 13 by 23 inches; of wing $8\frac{3}{4}$ inches.

Mr. Jerdon rightly remarks—"The blue pigeon abounds all over India, being occasionally found in the more open spaces of jungles, especially in rocky districts and in the neighbourhood of water-falls; but more generally in the open country, inhabiting walls of villages, pagodas, wells, and any large buildings, and breeding chiefly in old walls." Another observer, writing of it in the eastern districts of Bengal, remarks: "Large colonies of these birds inhabit every moogur, mhut*, and mass of ruins in the country, where, in company with the (house) mynah and (rose-ringed) parroquet, they multiply to a vast extent; and the more so, as being held in religious veneration by some, and in special favour by all natives, their destruction is prevented wherever there exists the power. They are so devoid of timidity, that even in the midst of crowded cities, they will build on the cornices in the open verandahs of inhabited houses. When this takes place in the dwelling of a native, their tenure is secure; as their making such selection is looked upon as a happy omen, and their dismission as the sure forerunner of evil fortune. Pairs frequently take up their quarters among the domestic pigeons of the dove-cot; indeed it is not an easy matter to prevent their doing so, and intermingling the breed. In the cold weather they flock and frequent the paddy-stubble in large numbers†." Capt. Hutton informs me that this bird "is found in Affghanistan, where, as in many parts of India, it builds in wells and ruined buildings: the *kazeezes*, or Artesian wells of Affghanistan, are sometimes crowded with them. They occur also in the Doon, and are known as the common blue pigeon. At Mussoorie, I have only seen them in the cultivated fields, low down on the sides of hills, in warm situations‡."

Being the original stock of the domestic pigeons of India, some notice of the latter should here be introduced. I have not, however, paid much attention to the several varieties; the more choice

differences, whether of size, proportions or colouring, and if they manifest no tendency to grade from one to the other, except in cases of obvious intermixture, we are justified in considering them as distinct and separate; and more especially if each, or either, has a wide range of geographic distribution, without exhibiting any climatal or local variation.

* Rude Hindoo temple.

† India Sporting Review, No. 4, 121.

‡ *Columba intermedia* is exceedingly common in Chota Nagpore, breeding in all the steep lofty rocks of that country.—T.

of which are, besides, kept chiefly by the Moguls in the Upper Provinces, and it is there that observations should be recorded of them. A chapter is devoted to the rearing of pigeons in the *Ayeen Akbaree*, and a number of breeds or races enumerated; but nothing definite can be understood of their distinguishing characters. The different kinds are chiefly esteemed for performing sundry aërial evolutions, and returning at once from any height at an accustomed signal. But to quote the work cited: "There are also many other beautiful pigeons, which, although they neither wheel nor tumble in the air, yet perform many pleasing tricks; amongst these are the following:—The *Kowkh*, which seems to say the words *yak-roo*. The *Luckeh* [*fantail*], whose cooing is very agreeable, and he carries his head with astonishing pride and stateliness. The *Lowtun*, who upon being shaken, and then put upon the ground, jumps about with strange convulsive motions." [This may be seen at any of the Calcutta bird-dealers; shaken two or three times in the hand, and the head more especially, the poor bird tumbles about in a fit for some seconds, when the owner recovers it by blowing hard in its face. They are chiefly black and white and bare-legged, with a crested occiput, but present no other marked distinction.] "The *Kehrnee*, who has such amazing affection for his hen, that when he has flown out of [human] sight, if she is exposed in a cage, he instantly drops down upon it: they descend either with both wings spread, or with one open, or else with both shut. The *Ruhteh* is a pigeon famous for carrying letters; but any pigeon may be taught to do this. The *Neshwaree* ascends in the air till he is out of sight, and remains so [*i. e.* absent ?] for a day or two, after which he alights on the ground. There are also many other kinds that are valuable only on account of their beauty, such as the *Sherazee**, the *Shushtree*, the *Shashenu*, the *Jougeeah*, the *Rezehdehn*, the *Muggessee*, the *Komeree*, and the *Gowlah*; the last [or *intermedia* in its natural state] is a wild pigeon, of which, if a few are taken, they are speedily joined by a thousand others of their kind. There are people who obtain a livelihood by sending these pigeons to feed abroad, and making them vomit up the grain, by giving them water strongly impregnated with salt. A pigeon is said to live to the age of thirty years." Among the kinds commonly bred about Calcutta are fine *Powters* (*Gulla-p'hoola*†), both feather-legged and bare-legged; *Fantails* (*Luckah*) of indisputable merit, but poor helpless monstrosities, except in the eyes of connoisseurs, some of

* *Sarajoo*, Beng. A large black pigeon, with white rump, quills and under-parts from the throat; generally very true to this colouring.

† 'Swollen throat,' or, literally, *full gullet* (*gula*).

which have at least thirty-six tail-feathers*, and races with an occipital top-knot (*Nuns*), are common; but I have seen nothing like the variety commonly bred by English *fanciers*, and the races generally are less pure (at least in Lower Bengal), with their peculiarities not so strongly brought out; unless in the instance of the *fantails*, and sometimes *powters*, which are as preposterous caricatures of the wild race, as the most extravagant admirer of Nature's freaks of the kind could reasonably desire, and as undeniably curious in showing what domestication can produce.

C. LEUCONOTA, Vigors, Proc. Zool. Soc. 1831, p. 22; Gould's Century, pl. 59. (HOODED ROCK PIGEON.) Size and form of last, the wings a trifle longer: cap, comprising the throat and ear-coverts, ashy-black; neck, rump (as in *C. livia*) and the entire under-parts white, with a faint shade of ashy, except on the rump, deepest on the lower tail-coverts; interscapularies, scapularies and wings light brownish-gray, purer pale ashy on the medial coverts of the wings; the primaries dull blackish towards their tips, the secondaries broadly tipped with dusky, and the tertiaries and their coverts having a subterminal dusky band and broad grayish tips, producing a series of three short bars, successively smaller to the front, and a trace of a small fourth band anteriorly; tail and its upper coverts ashy-black, the former having a broad grayish-white bar, occupying the third quarter from the base of its middle feathers, and narrowing and curving forward to reach the tip of its outermost feathers. Bill black, legs pinkish-red, and irides yellow. Common on the rocky heights of the Himalaya, inhabiting near the snow line.

According to Capt. Hutton, there are two races, if not species, confounded under *C. leuconota*, viz. the true *leuconota*, as figured by Gould, with the white of the *hind-neck* spreading a considerable way down the back, and which (he informs me) is found only "far in the mountains;" and another, of which the description wholly corresponds with the Nepal and Darjeeling specimens which have served for the above description, and which Captain Hutton states "inhabits the Doon all the year, but is there called 'Hill Pigeon,' while the other is known to collectors as the 'Snow Pigeon.' The Doon bird flies in small flocks during summer from the hills to the Doon in the morning, and returns to the hills in the evening." If there be really any difference, however, between the birds adverted to, I suspect it must be merely one of age.

Subgenus PALUMBUS, Kaup. WOOD PIGEONS or CUSHATS. These have feet well adapted for perching, and a shorter tarse than in the preceding section, which also is more feathered

* While drawing up this notice, I visited the bird bazaar, and counted thirty-four feathers in a tail which was obviously imperfect.

towards the knee. They nidificate and habitually perch on trees*.

C. PALUMBUS, Linn. (EUROPEAN WOOD PIGEON.) Upper parts brownish-gray, the head, cheeks, throat, rump and upper tail-coverts pure ashy, paler on the lower tail-coverts; fore-neck and breast vinaceous-ruddy, weaker on the belly, and albescent towards the vent; nape and sides of the neck and shoulders glossed with changeable green and reddish-purple, the former predominating above, the latter below; and upon each side of the neck a great patch of subdued white, in general largely developed, very rarely reduced to a mere trace; coverts forming the edge of the wing and impending the winglet white, as is also the exterior margin of each primary; tail gray at base, becoming blackish at its tip. Bill orange, with a white mealiness at the tumid base of its upper mandible; feet red, and irides light yellow. Length 17 by 30 inches, and wing 9½ inches.

This well-known European species inhabits the north-western Himalaya, as about Simla, and in the Alpine Punjab.

C. (?) ELPHINSTONII: *Ptilinopus Elphinstonii*, Sykes, Proc. Zool. Soc. 1832, p. 149: a *Carpophaga*, apud G. R. Gray. (NEILGHERRY WOOD PIGEON.) "Upper parts fuscous-brown, the head, neck and lower parts ashy; nape black, the feathers marked with a white spot at tip; interscapularies ruddy; neck and breast glossed with emerald-green, the rump with ashy; first, second, third, fourth and fifth primaries having their outer web emarginated. Irides ochre-yellow." Length 15 or 16 inches.

I have had no opportunity of examining this fine species, but from the above description of its plumage, translated from Colonel Sykes's brief Latin definition, I cannot help doubting exceedingly the propriety of arranging it as a *Carpophaga*, and as strongly suspect that the present is its true systematic station†. Colonel Sykes describes it to be "a rare bird in the Dukhun, met with only in the dense woods of the ghauts. Not gregarious. Stony fruit found in the stomach. Sexes alike. Flight very rapid. The lateral skin of its toes is very much developed." Mr. Jerdon has only noticed it "in the dense woods on the summit of the Neilgherries, in small parties, or single. It is a retired and wary bird. I found various fruits," he adds, "and small shells in its stomach."

C. PULCHRICOLLIS, Hodgson (mentioned in Mr. G. R. Gray's

* It should be remarked, that the European *C. œnas* is completely intermediate to these two groups in its form, colouring, habits and nidification; breeding sometimes in the cavities of trees, sometimes in rabbit-burrows.

† Mr. Blyth is right in this surmise; *C. Elphinstonii* being a true *Columba*, not a *Carpophaga*. The lateral skin of the toes is not more developed than in *C. palumbus*.—H. E. S.

Catalogue of the specimens of *Columbidæ* in the British Museum). (Ashy Wood Pigeon.) Considerably smaller than the two preceding species; and general colour dusky-gray, much paler and faintly tinged with lake below, more or less whitish towards the vent, and subdued white on the lower tail-coverts; tail blackish; head, cheeks and ear-coverts pure light ashy, passing to whitish on the throat; the sides of the neck and breast brightly glossed with the usual changeable green and reddish-purple, the former predominating; and above this the feathers are somewhat rigid and black at base, with broad isabelline tips whitish at the end, forming a large patch on each side confluent behind. Corneous portion of the bill apparently pale yellow, and legs probably pink, but fading to amber in the dry specimen, of which colour are also the claws. Length of wing $8\frac{1}{2}$ to 9 inches. Common in the wooded region of the eastern Himalaya.

C. punicea, Tickell, Journ. As. Soc. xi. 462*. (Pompadour Wood Pigeon.) General colour deep vinaceous-ruddy, weaker below, and most of the feathers margined with glossy changeable green and amethystine-purple, the former colour prevailing on the neck and sides of the breast, the latter elsewhere: whole top of the head, including the occiput, whitish-gray; alars and caudals blackish; the primaries tinged externally with gray; upper and lower tail-coverts nigrescent; bill yellow at tip, its basal half blackish in the dry specimen; "irides orange with a red outer circle; feet dull lake." Length about 16 inches, of wing 8 inches, and tail 7 inches.

This handsome pigeon inhabits the hill forests of Central India, also those of Assam, and would appear to be tolerably common in the island of Ramree, Arracan. I have never seen it from the Himalaya†.

C. Hodgsonii, Vigors, Proc. Zool. Soc. 1832, p. 16: *C. nipalensis,* Hodgson, Journ. As. Soc. v. 122‡. (Speckled Wood

* Type of *Alsocomus,* Tickell.

† *C. punicea.* Length 16 inches by 2 feet spread; wing $8\frac{3}{4}$ inches. Bill greenish-yellow, with basal half livid. Iris amber-yellow in an orange-red circle. Legs and feet dull lake. The female is similar to the male, but rather smaller and duller in plumage. This species is not uncommon to the south of Singbhoom, going in small parties of four or five, and always along the banks of rivers which are shaded by large forest-trees. Up and down these noble avenues, which the green shades of mingling boughs above, and the clear rippling stream below, preserve at all hours and seasons pleasantly cool, these pigeons fly, rarely taking when disturbed to the more open tracts distant from the stream. In January 1842 I killed five specimens on the Bytarnee river in Singbhoom. They were feeding principally on the jamoon. These birds feed chiefly in the morning and again at evening, and during the heat of the day roost on the uppermost branches of the huge derris trees, common in that country. They are wary and difficult of approach.—T.

‡ Type of *Dendrotreron,* Hodgson.

Pigeon.) Above dark vinaceous-ruddy, with white specks on the medial coverts of the wing; head and upper part of front of neck cinereous, with a vinous tinge in some specimens; rump, upper and lower tail-coverts dusky-ash; tail ashy-black; the great alars brownish-dusky, the first three primaries having a slight whitish outer margin in some specimens; exterior wing-coverts grayish; nape, sides of neck and lower parts vinaceous-ruddy at base of feathers, margined (more broadly on the side of each feather of the breast) with vinous-gray, which increases in quantity upwards, till the surface of the plumage appears solely of this hue, while the dark vinous tint predominates more and more towards the belly; the red portion of each feather appears thus as an obtusely pointed spot upon those of the breast, and on the feathers of the neck is darker and acutely pointed, being there uniformly edged with the pale ashy margin. Bare orbital space livid; bill purplish-black; "irides hoary or gray-white; legs and feet black-green to the front, yellowish elsewhere; claws clear lively yellow." Length about 15 inches by 25 or 26 inches in alar expanse; wing 9 inches to $9\frac{1}{4}$. "Female," according to Mr. Hodgson, "rather less, and differing in having the bluish-gray of the head less pale and clear, and in wanting almost entirely the purplish tinge which adds so much beauty to certain parts of the plumage of the male, as especially the upper part of his back and the lower part of his belly."

"This elegant species," continues Mr. Hodgson, "is found in the woods of the valley of Nepal. It is very shy, seldom or never entering the cultivated fields for the purpose of feeding, but keeping almost always to the woods, and living upon their produce, in the shape of grass, seeds or berries." It would seem to be not uncommon near Darjeeling: and Captain Wroughton informs me, that it is also tolerably numerous about Simla and Mussooree, where it frequents the pine forests on the higher mountains, as Whartoo and the vicinity of Kotghur. They are generally seen in flocks of six or seven, which are particularly shy and difficult of approach.

C. Hodgsonii is nearly allied to *C. arquatrix* of Southern Africa; but is at once distinguished from that bird by its blackish bill, by the gray upon its head and neck, and by the reduced development of the nude space surrounding the orbits. Another allied African species is the *C. guinea*, Linn. (*v. trigonigera* of Wagler).

[To be continued.]

XIV.—*On the Development of the* Lycopodiaceæ. By Karl Müller*.

[With five Plates.]

[Continued from p. 40.]

§ 5. *The perfect Plant.*

We have here to consider:—1. the *axis of the branch*; 2. the *roots of the branch*; 3. the *leaves*; and 4. the *organs of reproduction*.

1. *The axis of the branch.* The germinating plant divides, as we have already seen, normally into two branches, consequently it is bifurcated. The same kind of division is exhibited throughout the whole growth of *Lycopodium denticulatum*. The branches are always dichotomous, the vascular bundle always dividing in this manner.

The branches, as is known, are compressed on the upper and under sides.

Interiorly they are composed of numerous layers of cells. At first two circular spots are found in the centre, lying at some distance from each other. In these situations are produced the vessels, which as usual are surrounded by long, prosenchymatous cells (Pl. III. fig. 12). They lie within the latter as a simple and almost circular group. From these vascular bundles proceed outward a number of tubular cells which finally come in contact with a layer of delicate and short parenchymatous cells. These last are the only cells throughout the whole axis of the branch which as yet contain any of the "cell-contents" (fig. 12 *a*), which consist of very small yellowish green granules, more or less collected into groups. The whole is inclosed by several layers of thin-walled, transparent and short parenchymatous cells. The layers situated most externally (the cortical layers) consist of cells which are always somewhat more elongated and more slender, and are not hexagonal, but have the form of parallelograms. Toward the terminal bud, the cells of the axis all become smaller and more crowded, till at last they look like mere globules (fig. 13).

All these conditions vary in the most manifold way in the stems of the other *Lycopodiaceæ*. This is especially the case with regard to the grouping of the vascular bundles. The structure of the cell-membrane also is very variable among them. These however are conditions of which a further examination would be extrinsic to my design. Most of them indeed are already known, and only individual cases require pointing out. The development

* From the 'Botanische Zeitung,' Aug. 28, and Sept. 4, 1846. Translated by Arthur Henfrey, F.L.S. &c.

of the cells of the terminal bud remains yet to be traced. I therefore next consider—

2. *The roots of the branch.* These are solid round bodies, almost perfectly cylindrical, which always split, like the axis, dichotomously when they come in contact with the ground, penetrate it, and attach the plant more firmly to it. When growing in pots however, as in our green-houses, and not long enough to reach the earth, they do not divide.

Interiorly they are made up of the same kind of cellular tissue as the axis of the branch; but the cells are firmer. They never contain more than one vascular bundle, and also differ from the axis in the fact that this bundle is not attached to the cortical layer by those tubular cells, whereby a large empty space is formed in the centre of the axis of the branch.

The most remarkable point about them is their extremely regular occurrence upon the axis of the branch. They *always* make their appearance in the situation where the axis splits into two, and in fact immediately in the axil of the last or penultimate leaf of the branch (Pl. II. fig. 17), which leaf is always a *folium intermedium*; the root consequently is always developed upon the upper side of the axis. Schleiden (in his Grundzüge, ed. 1. part ii. 80) expressly says of the roots, that they proceed from the under side. He has not mentioned the species in which he observed this, and therefore I am still in doubt as to the truth of the statement.

The rootlet appears at first as a little papilla upon the axis of the branch. This soon developes into a conical projection, and as soon as it has attained a certain length, which is not very considerable, the little cone curves downwards. This structure begins to be developed almost in the earliest stage of the growth of the axis of the branch, and the rootlet itself is found in that situation where the organs of reproduction are produced; a condition to which I shall have again to refer hereafter. Every joint of the branch consequently possesses a root at its base. A successful transverse section exhibits the history of development in the interior; at the particular point of the axis, where the root is to be formed, the tubular cells round the vascular bundle partly disappear; with the disappearance of these the vacant spaces also vanish, and the cortical parenchyma now immediately invests the central vascular bundle. On the upper side of the axis alone, consequently directly at the spot where the rootlet subsequently becomes visible, some tubular cells still occur, which however are of small importance compared with the former of the axis of the branch (Pl. IV. fig. 1). Indeed they are really only parenchymatous cells elongated upwards. Since these cells are wanting and the parenchyma is thus brought close to the vascular bundle, the nutrient fluids must naturally become con-

centrated at this point. This is in fact the case. In that situation where the root is to be formed, the cells soon become filled with a matter which distends them and is reddish like the often-mentioned material for development (*cytoblastema*). The root now begins to shoot outward, and may indeed be caused to project out by a simple mechanical process, by the expansion of its cells. The elongation continues to increase, the apex of the rootlet always remains filled with cytoblastema, and the older portions finally exhibit perfect cells, among which a delicate vascular bundle then soon penetrates, being a branch from the larger one of the axis of the branch (Pl. IV. fig. 2).

3. *The leaves.* As to their form and position, these conditions have already been examined in the germinating plant, to which I have only to add, that the perfect leaf of the axis of the branch is produced downward at its posterior face into a kind of tail, is enlarged into a roundish projection, and has the base so detached from the axis of the branch, that this apparent appendix looks like that appendage which we at first found on the basis of the envelopes of the bud (Pl. III. figs. 11 *d*, 11 *x*). However they cannot be confounded, since that is always a much more delicate, simple membrane, while here the green cellular tissue of the leaf usually extends to the apex of the appendage. It is only necessary, then, to speak of the relations of the leaf to the axis of the branch.

When a leaf is about to be developed upon this, a little elevation may be perceived upon its terminal bud. This prominence consists of an evident extension of the parts at the circumference of the axis of the branch, *i. e.* the young leaf at its first appearance is a flattened shoot, which has only to become extended in length and breadth to form a perfect leaf. In the interior of this shoot the material for development (*cytoblastema*) shows itself, and as the lamina extends itself, the cytoblastema is gradually converted into cells. At the same time, and equally keeping pace, a branch of the central vascular bundle—which always reaches almost to the point of the terminal bud and also keeps pace with its elongation—proceeds across through the delicate parenchyma in the interior of the leaf (Pl. III. fig. 11), where it terminates abruptly or in a clavate form, as in Ferns. At the same time, the long parenchymatous cells clothing the vessel naturally accompany it into the leaf, and around these assemble also the tubular cells. And thus the tissue of the leaf appears spongiform in the cross-section.

It must here be noticed, that both in the young branches and in the terminal bud, the surface of the axis of the branch is formed of a single layer of elongated cells (fig. 13), while at a

later period several layers of similarly elongated cells clothe it (fig. 11 *b*).

The surface of the young leaf of *L. denticulatum* therefore consists of but one single layer of cells, which developes into the proper epidermis, subsequently contains *porous orifices*, and always remains as a membrane composed of a single layer. Its cells are always hyaline and of flattened form. Next to it interiorly follows a layer of larger, round cells, next the spongiform tissue, and lastly, the vascular bundle with its appurtenances.

The larger, round cells originally possess a nucleus which is firmly attached to the interior of the cell-wall: it is green and somewhat compressed. In this form it resembles a cytoblast, persisting in the cell, and I consider it as one, and that it has been converted into chlorophylle. Subsequently it separates into several granules, but not into many (fig. 11 *c*).

The leaves are consequently only prolongations of the parenchyma of the axis of the branch-axis, and never attain an independent position, as they universally remain attached by the whole base.

The relations of the leaves to each other is such, that the older, the inner face of which have by this time become concave, overlie the younger, and so on until we arrive at the delicate terminal bud which is completely inclosed by them, and, like the young, delicate and almost transparent leaves, is thus protected.

4. *The organs of reproduction.* I now come to a point which is undoubtedly the most important of all, since it exercises the most direct influence over the systematic position of the *Lycopodiaceæ*. This is the morphological import of the organs of reproduction. Having been long known, this question has not passed unnoticed. The first who expressed an opinion on the subject was Bischoff in his 'Lehr. d. Bot.' 1 Th. 421. He says, "The position of these fruit (this refers both to the oophoridia and antheridia) in the axil of the leaf appears to indicate that they are buds, the leaves of which, united in the younger stages to form the envelope of the fruit, separate when it is mature; they do not possess however the epidermal layer on the upper face. In favour of this view may be instanced the two- or three-chambered fruit of the foreign genus *Psilotum*, in which, at its first appearance, the corresponding number of leaves may be perceived, and which generally resembles in structure a chambered capsular fruit."

On the other hand, H. Mohl in his memoir above-cited (Morph. Betr. über das Sporang., &c.), p. 29, opposes this, and for two reasons: "In the first place," he says, "it appears that the sporangium is not actually situated in the axil of the leaf. This is

shown indeed, although not very distinctly, by a careful examination of *Lycopodium*, in which it may be observed that the base of the sporangium is connected equally with the mid-nerve of the leaf, in the axil of which it is situated, and with the stem, so that its true point of insertion remains doubtful; this condition however is better marked in *Psilotum*, especially in *Tmesipteris*, as here the capsule is attached in the incisure of the leaf." The author then comes to speak of *Isoëtes*, where also two kinds of spores occur, by which the affinity to *Lycopodiaceæ* is so distinctly shown, and says that in *Isoëtes* the sporangia are decidedly not axillary but proceed from the leaf, whereby it is rendered probable that this is also the case in the *Lycopodiaceæ*, and that the sporangia are productions from the leaves. He further says, p. 30, "The position of the sporangium on the leaf of *Psilotum* might indeed be explained by an adhesion of the fruit-stalk to the leaf, but on the other hand there is the opposing circumstance, that in this family generally the fruit-stalk is remarkably short, and in *Isoëtes* no trace of it is to be found."

A second evidence against Bischoff's view is found by this author (Mohl) in the development of the spores contained in the fruit of the *Lycopodiaceæ*, "since this takes place in the same manner as in Ferns and the pollen-granules of the Phanerogamia, in mother-cells which fill the cavity of the fruit, and therefore indicates that it occurs in the interior of a cellular organ even as it does on the surface of a foliaceous part."—"This circumstance," he says further, p. 31, "appears to have led Bischoff to the assumption that the epidermis is wanting on the upper side of the carpellary leaf. The assumption, that in the single carpellary leaves, the face, folded inward, disappears either at first or during the course of development, and that the cavity of the carpel becomes filled with mother-cells which originate from the naked mesophyllum there present, is not indeed impossible in itself, but it is too little supported by any analogy to allow of our accepting it as valid without further examination of the point, in the present case where the position of the fruit generally renders its derivation from the leaf doubtful."

By these statements, Mohl endeavours to controvert Bischoff's view, and to render the other probable, that the sporangia of *Lycopodiaceæ* are productions from the leaves; for he says, himself, finally (p. 33), "the fact of the sporangium of *Psilotum* being two- and three-chambered, cannot, as it appears to me, be brought as an objection to the view thus proposed; for this structure may be explained as well by the growing together of two or three sporangia, formed like the thecæ of an anther, as by the union of carpels, and this the more that we find an analogous fusion of sporangia among the Ferns in *Danæa* and *Marattia*."

The third investigator, whose opinions on this subject I have become acquainted with, is Schleiden. He declares himself most decidedly in favour of Mohl's view, and says (Grundzüge, ed. 1. part ii. 81), "that the spore-fruits are special modifications of the parenchyma of the leaf, has been shown by Mohl as clearly as was possible without tracing the development. This however affords the same results." From this last sentence we may guess that Schleiden had founded his very definite statement on an examination of the development. This however is not to be found in his earlier writings, and it is therefore very much to be regretted that this author has not given us a more detailed account of it!

How far my own investigations agree with the foregoing opinions, will best be seen after I have given the history of the development so far as I have arrived at any conclusions about it; these I hope however may solve the questions above stated.

1. *The spike* (spica nonnullor., amenta et strobilus. *Spring.*).

The inflorescence of *Lycopodia* is always to be regarded as a spike: the peduncles of the fruit may be abbreviated and the leaves be thus brought closer together, in which case the character of the spike appears most distinctly, or the leaves may remain in their original position. In this latter case the fruit is said to be scattered on the stem. It will be evident that I here of course only speak of the genera *Lycopodium, Selaginella* and *Phylloglossum.*

The form of the spike naturally depends upon the arrangement of the leaves of the species, and therefore has usually no remarkable differences from the preceding whorls of leaves. In *Selaginella* alone it is regularly altered in such a manner, that while the leaves of the compressed branches, in four rows,—two above and two below,—are distant and of two forms, the leaves of the spike are densely crowded and thus form a four-sided spike on the round axis; for the little uniform leaflets are strongly keeled, overlap one another regularly, and the keel is thus displayed at a prominent line on the spike (Pl. IV. fig. 13). Four such lines occur normally, and the four-sided form is thus produced as the fruit-leaves are compressed so as to form an angle. The spike of *Lycopodium denticulatum* is of this form. Two circumstances have an important influence over its perfect development. If the axis of the branch does not become attached to the earth by its roots—and this is often the case in plants raised in pots—the spikelet of the branch which has not attached itself by rooting is manifestly retarded in its development, and often to such an extent that it scarcely visibly projects beyond the leaves; but on the other hand, when the branches always root, the spikelet acquires a considerable height.

On this now occur oophoridia and antheridia. The character

of their occurrence varies in three ways. Either only antheridia appear on the spikelets (*L. Selago, clavatum, annotinum, inundatum*, the genus *Phylloglossum*, &c.), or only oophoridia (*L. selaginoides*), or both organs together. Here belongs *L. denticulatum*, apparently together with the whole genus *Selaginella* and some annual species of the genus *Lycopodium*, which represent, as it were, the pigmies of the *Lycopodiaceæ*, e. g. *L. gracillimum* and *pygmæum*. In these two the oophoridia are situated under the antheridia at different points on the spike. On the other hand, in *L. denticulatum* and other *Selaginellæ* in which I have become acquainted with the formation of the fruit, only one single oophoridium occurs on the spikelet, and that *always at its base*. This becomes of very great importance when we seek to discover the import of the oophoridium, and will be spoken of hereafter. In development however it is the simplest case, and therefore the most instructive.

Examining the base of the spikelet of *L. denticulatum* more closely, the oophoridium is found to rest upon two leaves, two *folia intermedia*. The spikelet, which beyond this point bears only antheridia, also has intermediate leaves from its very base, that is, on the side opposite the oophoridium, and the whole spikelet is furnished with them.

To trace the structure of the fruit-bearing portion of the axis, we must go back to the earliest condition of the terminal bud. The dichotomous division is always strongly marked in this bud, since the apex of the axis is always broader and more thickly clothed with leaves than the inferior portion. Inquiring into which portion is developed into the fruit-stalk, a very careful examination shows that it is *always that lying to the right hand*. That there may be no doubt as to left and right, the plant must be looked on from above. The upper side however is always that on which the *folia intermedia* are attached. When the axis has divided into two branches, that part lying to the left of the axis elongates and always divides in a similar manner further on, whence it generally happens, that the direction of the right-hand branch of the left axis is always diverted a few degrees towards the left as in all cases of bifurcation, and thus the plant is in a condition to spread to such an extent that it covers large circular areas.

So much for the fruit-bearing axis. I have now to explain more specially the development of the oophoridium and the antheridia, in order to make out their morphological import.

2. *The oophoridium.—a. The formation of the sporangium.* I do not dwell long upon the description of this, since its structure is nearly or almost wholly similar in most species, and may also be regarded as sufficiently understood. It is, briefly, a sporan-

gium of about the same size as the antheridia, the periphery presenting four rounded projections. These projecting portions are always opposed in pairs, so that their lines of intersection cross (Pl. IV. figs. 3—5). Schleiden (Grundz. ed. 1. ii. 82) calls it a rounded tetrahedral fruit; but the expression "*four-knobbed* (vierhügelige) *fruit*" appears to me much more indicative of its character, as a rounded tetrahedral form does not include the rounded projections which so distinctly occur. At its base the oophoridium is furnished with a short pedicel, compressed on two sides, which consequently resembles the axis of the branch (fig. 3). Around this pedicel is a circular spot consisting of delicate, minute and hyaline cellular tissue (fig. 4). From this runs out on each side a long, elliptical space which also consists of the same delicate tissue (fig. 4). The latter spaces indicate the line in which the oophoridium subsequently opens, without being itself actually torn. In *L. gracillimum* these two long spaces are dichotomously divided. The line of dehiscence also extends over the crown of the sporangium (fig. 5). The crown however is usually regularly depressed inward in the younger stages. The membrane of the oophoridium is composed of a layer of dense parenchymatous cellular tissue. On the inner wall of this is usually found an irregularly deposited, green cellular mass, which is apparently a secondary deposit: this is what we find in *L. denticulatum*. The four germinative spores found in the sporangium have already been spoken of in § 2; they form the four projections of the oophoridium.

When the fruit-bearing axis is examined in a very early condition—and this is necessary, since the organs of fructification are very rapidly developed—a relation between the oophoridium and antheridium shows itself, which cannot easily be detected in the subsequent fully-developed condition. The spikelets bearing the oophoridium and the antheridia here appear as perfectly distinct parts (fig. 6): they deviate from each other dichotomously, just as the young forking branches of the axis do. The oophoridium is at this time externally an almost angular, roundish, inflated body, the breadth not exceeding the length (fig. 6 *a*); but very soon, after it has produced the four spores in its interior, it acquires the already-noticed four-lobed form with much more distinctness. The oophoridium is then, generally, of a longish shape and compressed on two sides (fig. 10). In this ellipsoidal form it stands with the longer face on the base of the spike, so that the angle of the spike, produced by the above-described keel of the leaf, corresponds approximatively to the middle of the oophoridium (13 *a*). If this organ is now looked at laterally, so that the two prominences *a b* in fig. 10 lie on a level with the eye of the observer who thus looks along the long

vertex of the ellipsoid, this vertex appears somewhat depressed inward as if emarginate (fig. 12 *a a*). If it is then looked at again on the side which brings the long face (*c d* in fig. 10) across the eye, the long side appears as a rounded trigone (fig. 11 *a b* is the other side lying behind). In all these forms the oophoridium can externally only be made out to be a vesicular projecting organ, and naturally so, since the four spores have not yet become developed into compact masses. In proportion as the spores are perfected it appears to become gradually denser until it acquires the above-described four-lobed shape.

Here, before we know anything of the interior of the oophoridium, the question proposes itself, *What is the oophoridium actually?* According to all that I have hitherto said about it, the oophoridium is *the whole, metamorphosed terminal bud of a main axis. It is therefore an axial organ.*

Most important grounds support this opinion. The first is the independent position of the oophoridium, opposite the spike, in the early condition (fig. 6 *a*). Here we distinctly see *the oophoridium and spikelet are the two metamorphosed branches into which a main branch has just divided.* In a later condition it does certainly appear as if both oophoridium and spikelet belonged to one single axis. There can however be so little doubt about our having to do with two branches, that in the absence of other argument, this mode of development alone would be sufficient to warrant my opinion. All that a branch possesses is found with the oophoridium, since we have already seen above that it is protected by two leaves; and these two intermediate leaves are to be regarded as the two first of that which is here developed into an oophoridium. We also saw above, that near the oophoridium and the spike is often produced the same root which appears in the bifurcation of a main axis. Moreover that in *L. denticulatum,* as in most of the *Selaginellæ,* only one oophoridium is found on each fruit-bearing axis, speaks equally in favour of my view, since it stands in exact connexion with the scattered fructification of the said axis. The branches divide too frequently in *L. denticulatum* for the branch to produce many fruits. It is too thin to form a main axis out of which oophoridia might be developed. The case is different in *L. selaginoides.* Here the axis of the fruit is very thick, and thus it is suited to form *branches* which may develope into oophoridia. Another proof is, that in the young condition the oophoridia are all compressed, as the branch of *L. denticulatum* always is, since the oophoridium is in fact only the transformed apex of the branch. The internal course of the vascular bundle is even a better evidence, for a vascular bundle runs into the pedicel of the oophoridium (fig. 14), a condition which must be

further examined hereafter. Finally, the view becomes incontrovertible from an anomaly which I have observed once, *where both the branches of the fruit-bearing axis had been transformed into oophoridia.* Here of course the spikelet was wanting, and two oophoridia were opposed to each other, the most complete proof that the terminal bud of *that* branch had been transformed into an oophoridium, which properly should have produced a branch.

It would be very interesting to trace the formation of the oophoridia in a fruit-axis which bears these organs alone, as in *L. selaginoides.* Here the axis of the branch is very slender, as in *L. denticulatum,* but the formation of the oophoridia, which takes place within a spike, is distinct. This is explained, as we have already seen, only by the thickness of the *fruit*-axis, as this increases in thickness as it proceeds upwards, and does not branch beyond like the inferior portion of the axis of the branch. This ramification however occurs again above in a more evident degree, since the individual joints of the axis become so distinctly shortened that the stalk of the spikes becomes diverted outwards. Here also there is no doubt that the oophoridium is a metamorphosed branch, and a history of the development of this most interesting species is very desirable.

Consequently the view of H. Mohl and Schleiden in reference to the oophoridium, that this sporangium is a production from the leaf, is certainly incorrect; neither is it formed of carpellary leaves, as Bischoff endeavoured to show.

b. The formation of spores. A new question to which I now come relates to the formation of the four germinative spores in the interior of the oophoridium. I regret that I cannot offer a perfect account of their development. What my researches have hitherto made me acquainted with on this point is limited to the following.

If we cut through the oophoridium in the direction of its length in a very young condition, the view of the interior confirms what we have above concluded from its external conformation. The membrane of the oophoridium is a mere development of the apex of the axis and is identical with the epidermis of the leaf, both being formed by the outermost cellular layer of the axis (figs. 7, 8). It is only at a subsequent period that the leaf acquires an organ, the porous slit, which never shows itself in the oophoridium. The membrane of the oophoridium is not equally strong at all points, but much thickened at the vertex (fig. 7 *a*). It is also decurved somewhat over its point of attachment, the future pedicel (fig. 7 *b*), whence this latter comes to be situated in a longitudinal fold which is continuous with the base.

Projecting into the interior of this cavity may now be discerned a more or less roundish vesicle (figs. 7 *c*, 9 *a*). This is formed of a very delicate, homogeneous membrane, perfectly hyaline, therefore devoid of contents, and surrounded at its base by a great number of smaller, more or less hyaline cells. This vesicle is now apparently only the apex of the proper central axis of the vascular bundle, as may be seen in figs. 7 and 9; and those cells occurring at the base of the vesicle are the terminal ones of the axis of the branch, the growth of which has not nearly kept pace with that of the external cortical layer of the branch-axis, and thus the cortical layer has become isolated and appears as the sporangium. These cells subsequently acquire some green contents; but they undergo no further development, and exist in the perfect oophoridium merely as a compact mass of cells out of which project the four spores.

The four spores however are formed in the vesicle produced from the apex of the vascular bundle, and I have hitherto only met with them in one single stage (fig. 15). Here they all four lay closely grouped together and occupied the greater part of the cavity of the vesicle. Each spore was already composed of a very delicate, somewhat reddish-coloured membrane, *which however though still so young was already cellular*. This last circumstance has as yet remained perfectly incomprehensible to me.

Should subsequent investigations show that this cellular structure is only apparent, and that this appearance coincides with the ridge-like projections which so often occur on the pollen-grains of the Phanerogamia, the question of the origin of the four germinative spores would be very clearly solved. We should here have in the interior of the oophoridium exactly the same law, that the matter contained in a mother-cell in the pollen-grain is formed, regularly, into four portions—subsequently four pollen-grains. We should have, in this vesicle, an actual mother-cell.

The further development of the spore is nothing more than a gradual expansion of its membrane, *which soon acquires a yellow colour*. It is quite empty, the form flat and compressed, and tetrahedral in the same way as the antheridia-spores, so that a long ridge may be observed on it (fig. 16). Little elevations also soon show themselves upon it,—a sign that the membrane is becoming thickened by the deposition of membranous matter. As the spore increases in size however, the vesicle in which it was formed disappears, and the four spores, which were originally situated directly on the summit of the central axis, now lie scattered in the four projecting lobes of the spore (sporangium ?). They go on swelling and becoming more thickened, until they are at last found in that condition which was described in § 2.

The course of development of these spores must be very clearly

exhibited in *L. selaginoides*, where it must be possible to find a great many stages at one time on a single spike, as so many oophoridia occur on it. They must be also very easy to prepare for examination here,—a matter of exceeding difficulty in *L. denticulatum.*

In conclusion to these remarks on the oophoridium, two words on the affinities of *Isoëtes* and *Lycopodium*. It appears to me that this question involves the import which must be attributed to the large spore-sporangia of *Isoëtes*. Are these metamorphosed branches or not? In the latter case the affinity would be merely apparent, only inasmuch that both, *Isoëtes* and *Lycopodium*, exhibit two kinds of spores. In the former case, however, the affinity would be perfectly proved. The compressed, concentrated stem of the *Isoëteæ* would not be any great evidence against the affinity, since we have become, through Kunze, acquainted with the genus *Phylloglossum*. This is apparently a connecting link between *Isoëtes* and *Lycopodium*; and if A. Braun's opinion be correct, that *Phylloglossum* is to be regarded as a *Lycopodium acaule*, *Isoëtes* would also have to be regarded as a *planta acaulis* of the *Lycopodiaceæ*. It is readily conceivable that the term stemless plant is not to be taken here in its strictest sense, but rather to be understood as indicating a plant with an abbreviated stem.

Lastly, in reference to the import of the germinative spore of the oophoridium, Bischoff (Krypt. Gew. 126) has called them spore-bulbels (*tubercula sporoidea*), and compared them to the bulbels of *Arum ternatum* and *Dentaria bulbifera*. It is evident that this has no meaning till we know the whole course of development. The same applies to the expression *receptaculum tuberculiferum*, which he applied to the oophoridium. I have preferred the latter name because it is the more simple.

[To be continued.]

XV.—*An Outline of an Arrangement of Stony Corals.* By J. E. Gray, F.R.S. &c.

About ten years ago, when I arranged the Corals in the British Museum, I was struck with the difficulty of determining with precision the proper situation in the system either of Lamarck or De Blainville, of a large number of the specimens we then possessed, and in the 'Synopsis' I made some remarks on the variation which accidental circumstances, such as localities, &c., appeared to have on specimens of the same species. Since that period I have examined the collections of corals which have come in my way, and selected for the Museum collection the

specimens which showed any variation or peculiarity of structure. Being now called, by the increased space which I have at my disposal, to re-arrange the collection, I intend in the following paper to embody the result of my experience in the study of these interesting beings.

Pallas divided the Madrepores into seven groups, according to their general forms (Zooph. 275). Lamarck gave names to these groups, and extended their number, taking for the characters of his genera the form of the cell, the position of the mouth of the cell, and the distribution of the cells with regard to each other in the mass, and also if they were distributed on both or confined to the upper surface of the mass, and if the mass was fixed or free.

Forskal figured the animal of several species, Savigny in the great work on Egypt figured another, and arranged them with the harder *Actiniæ*; and subsequently Lesueur in three papers published in the Mémoires of the Museum and Philadelphia Journal, figured the animal of some other genera. Blainville with these materials and with the original drawing made by MM. Quoy and Gaimard in their 'Circumnavigation,' in his article Zoophytes in the 'Dictionnaire des Sciences Naturelles' (afterwards published separately as a Manual) attempted to characterize the genera by the conjoint consideration of the animal and its coral, paying more attention to the form of the cells than to the form of the coral and the distribution of the cells in the mass, and certainly he succeeded in much improving Lamarck's arrangement; and having Lamarck's original specimens within reach, he has referred them to their proper genera according to his view, and produced one of the best works on these animals which has yet appeared. Unfortunately, like Lamarck, having only isolated specimens, and often only fragments to examine, M. de Blainville has placed too much reliance on the general form of the corals: thus he divides his genus *Gemmipora* into arborescent, explaniform and crustiform; the *Montipora* into crateriform and explaniform species; the *Porites* into incrusting, conglomerate and branching species; when the same species of these genera may be found in each of these forms, and the species founded on these characters depend only on some accidental and often local peculiarity of the specimens, or may even have been broken from the same specimen.

M. Ehrenberg in 1834 proposed an arrangement of Zoophytes, which, though it has much the external appearance of novelty, made very little addition to the real knowledge of the stony corals; for his generic characters differ very little from those given by Lamarck and De Blainville, though they are expressed in a very different manner, and made chiefly to depend on the mode in which the buds are developed; and as this circum-

stance is in almost every instance only to be derived from the study of the result in the perfect coral, and not from the development of the buds of the animals themselves, I think it is better to state, as Lamarck and De Blainville have done, the description of the coral as found in the collection, than to give a theoretical account of the development of the buds, leaving one to divine what kind of coral must result from the development of the buds described. As was to be expected, the development which appears from the study of the *Polyphylliæ*, for example, in the different stages of growth in the same specimens, does not appear to agree with the theoretical development described by the author; for in the young state this coral has a single star with regular rays, and looks like an attached Fungia, but is rather more solid; new mouths, indicated by smaller stars, are gradually developed near the centre, the number increasing as the coral increases in size, and at length the mass becomes free and assumes the oblong shape. It appears to be one of the great defects of this arrangement, that the stony corals which are free in the adult state, as *Fungia, Haliglossa* and *Polyphyllia*, are separated from the others by *Pennatula* and its allied genera, because the author believes these *corals* to be internal and hence free; for we now know that these genera (which belong to two very different groups) are all in their young state attached like other corals. M. Ehrenberg compared these free internal corals to the bones of cuttlefish, and the plant-like or external corals, as he calls the other genera, to the shells of the oyster: he can only mean this as a resemblance as regards their position, for neither the internal *Fungia* nor the external *Cladocora* are deposited or formed like a shell, but merely consist of the hardening of the cellular substance of the animal itself by the deposition of cretaceous matter in the cavities of its cellular substance; and the *Fungia* is not truly internal, but placed in exactly the same situation as regards the coral as the other genera, and only covered with a reflexed part of the edge of the body. M. Ehrenberg divides the plant or external corals into two sections, those which have many and those which have twelve tentacles, but these divisions exactly agree with the sections named *Madrephylles* and *Madrepores* established by M. de Blainville.

M. Ehrenberg in the paper above referred to has described many new species; they have not been figured, and unfortunately his characters are not very clear and are difficult to understand, so that I am not able to refer to them with certainty, more especially as he places great reliance on the size of the coral and on the size of the cells. Now experience has taught me that both are very liable to variation even in different parts of the same specimen or group. In the 'Synopsis of the British

Museum' for 1842 I observe, "the form of the masses (of coral) appears to be greatly influenced by the position in which they have grown, and the size of the individuals (cells) greatly depends on the quantity of nourishment they are able to procure. This is proved by the fact, that if all the individuals of the same mass are equally exposed they are of equal size, but if the surface of the coral is waved as in *Explanaria*, the individuals on the convex part of the mass which could procure the most food are large, while those on the concave or sunken parts are small," p. 131. Continued experience and the examination of many hundred specimens have only extended and confirmed these opinions; consequently I expect that many of M. Ehrenberg's new species are what are only regarded in this paper as varieties: for example, he has described six species of *Seriatopora*; I have examined many specimens from different localities presenting differences of size and of comparative thickness and length of the branches, but am inclined to consider them as all varieties of the same species*.

It is a common error to regard the whole mass of a Brainstone, for example, as a living mass; this is by no means the case; it is only a very shallow coat on its outer surface, which is alive at one time; for as the animal increases in size above, the deposition of calcareous matter continues advancing below, and when that is completely deposited it is of no further use to the animal but as a support, and has no longer any organic life, for this part is in fact buried in its own secretion. This is the case with most of the coral animals, it is only the end of the *Caryophyllæ* or *Dendrophyllæ*, about as deep as the cavity of the cell, that is alive; the other part being merely a peduncle to support the animal. This is well seen in the *Oculina virginea*, where the older branches of the coral often become tubular.

This structure is further exhibited by the fact, that when any part of a massive coral is injured and the animal destroyed, the injured part is healed over by the lateral development of a thin layer of coral, which is not to be distinguished in appearance from the normal structure of the coral.

In general the edge of the cell and the laminæ within it are calcareous nearly to the surface of the animal, and in many of

* Since this paper has been in type, Mr. Forbes has kindly lent me a volume by Mr. Dana on the Structure and Classification of Zoophytes (Philadelphia, 1846), containing some very interesting observations on these animals made during the United States' exploring expedition. Mr. Dana's classification of the stony corals is only a slight modification of that proposed by M. Ehrenberg. The three works I have quoted have each a very different character;—the French clear, calm and minute; the German theoretical, almost mystical, and difficult; the American oratorical and high-flown.

these animals each individual is distinctly divided, and hence each cell has distinct parietes; but on the contrary in the *Porites* the separate animals do not secrete any calcareous matter between themselves, hence there are no distinct cells on the surface of the coral, and the coral is very porous, being pierced in every direction, and what are laminæ in other corals in this genus are only calcareous spicula.

The animals of the stony corals, besides being reproduced by eggs, which are developed between the septa of the stomach and emitted by the mouth, as in soft coralless *Actiniæ* or the coriaceous *Zoanthi*, and form new individuals or masses, also have the power of developing buds from their sides, or of increasing themselves by the spontaneous division of their stomachs, and it is by these means that the masses of coral are enlarged and continued; and the forms which the various kinds of coral assume in their growth, which gives the most prominent differences between their genera, depend on the manner in which these buds are developed, or the body of the animal spontaneously divided, each cell or branch being either the growth of a separate bud or resulting from this spontaneous division.

Before the spontaneous division of the animals takes place, the stomach enlarges and a new mouth opens near the original one in the disc, and from the mouth new radiating lamellæ arrange themselves, forming new centres, and this process is again and again repeated. Now as the laminæ of the coral represent the plates in the stomachs, and the centre of the plates the mouth, this kind of development may be observed in the coral nearly as well as if the animal was present.

The effect of this kind of spontaneous division on coral is very different in the two forms which the animals assume during their growth; and as these forms gradually pass into each other, so their peculiarities become less apparent. If the animal grows in height, raising itself on the gradually solidified part of the former coral, as in the branched *Caryophyllia fastigiata*, Lam., where the cells are round, they at length become oblong, then separate in the middle, the separation becomes more complete, and at length two complete similar cells are formed*, each placed on the end of a branch divided by a fork, and this process is repeated, forming a forked coral. The same kind of separation takes place in *Caryophyllia sinuosa*, Lam., but here the divided portions sometimes form separate stars, and at others only form new centres in the enlarged old star, which remains surrounded by the same edge. It is this latter kind of division which forms the elongated compressed cells of the *Meandrinæ* and the sinuous con-

* See Synopsis Brit. Mus. 1842, 130.

tinued cells of *Monticulariæ*; these forms gradually pass into the next form.

On the other hand, if the animal chiefly extends its size by spreading out laterally, forming a thin foliaceous expanded coral, the cell of the young animal has simple rays, as is shown in the young *Fungia Talpa*, Lam., in the British Museum; and as the animal expands, new mouths forming new centres are developed in the disc of the star. This is the mode of growth of the *Agariciæ*, *Pavoninæ*, &c., the animals being continually expanded towards the margins of the corals; and when the cavities of the stomach, separated by the septa which form the plates on the surface, are sufficiently expanded (or perhaps too much expanded for the food conveniently to reach them), then new mouths are opened; hence the mouths, and the stars indicating these mouths, are generally placed in concentric lines parallel with the edge of the corals. The foliaceous corals which are thus developed are easily known from those which are produced by buds, for in the latter instance (as the *Gemmipora*) the edge of the coral is formed by the last-formed buds or stars, while in these the edges are formed by the extended side of the stomach, and are thin and marked above with the laminæ of the stomach, the stars being some distance within the margin.

In these corals the animals form a common mass, the cell of the stomach of the different mouths having a more or less complete communication with each other, which is not the case with those which enlarge by buds, the polypes and their stomach being separate from each other, and the animal only united by their cellular integuments.

The manner in which the buds are developed also greatly modifies the form of the coral; thus if they are developed from the expansions of the base, the coral formed is crustiform or rounded, as in some *Astrææ*; and if from the upper part of the cell, then the coral is generally arborescent and branched. It may be observed that it is the marginal or terminal that is the last developed bud, which shows plainly the manner in which the buds are developed, as the after-development of the coral obliterates the separation between them; and further, when branches of different stems meet or cross they are frequently united together in a single network, as is the case with the horizontally expanded *Madrepores* and *Oculina virginea*, and if the branches are arranged parallel and by their growth become near each other, they by the development of the animal are united into a single expanded mass, as in *Madrepora palmata*, where the separate spike-like branches which are gradually united together to form the fronds are to be seen on its edges.

As in the coral animals which enlarge by the spontaneous di-

vision of their digestive cavity, so in these, there are all kinds of intermediate gradations between the two modes of development above described; indeed in some corals, as the *Madrepores*, in the early stages of the animal, the buds appear to be developed from the base of the sides forming a crust, and then one of the animals which is larger and stronger than the rest, ascends above the level, throws off buds from its upper part, and the coral becomes arborescent.

The buds are developed in various manners from the surface of the body; in the *Oculina axillaris*, Lam., they are emitted from each edge of the cells, and the coral becomes forked with the stars in the axilla; in *O. prolifera*, Lam., one or two buds are produced from one side of the animal; and hence a kind of secund arrangement of the cell. In *O. flabelliformis* a single bud is developed on one side of the animal, and then this developes another on the opposite side; so that the young cells form a kind of zigzag stem, and the whole coral assumes a fan-like shape; while in *O. virginea* and *hirtella* the buds are so developed, that the animal assumes a somewhat spiral direction, the cell at the tip being the one last developed.

In other corals, as the *Seriatopores*, the buds are developed in pairs on the alternate side of the branch, hence the cells appear in longitudinal series; and lastly, in the *Porites*, *Pocillopora* and *Sideropora*, each of the animals at the end of the compressed branches developes a bud on the upper side, and the branches are prolonged.

In other corals a single animal continues to ascend, and as it grows developes from its sides a succession of buds which form lateral cells; some of these being produced form branches emitting buds like the original stem. This is well seen in *Caryophyllia ramea*, Lam., where the lateral cells and branches are smaller than the main stem; sometimes, as in *C. flexuosa*, Lam., where the whole coral assumes a subglobular shape, the branches are nearly as large as the stem. In the genus *Madrepora* the original animal as it elongates gives out a succession of buds on all sides, forming subspiral whorls of cells round its base; some of these cells in their turn becoming the parent of a similar set of buds. It is this original cell which forms the "*apex perforatus*" in Lamarck's description of these corals.

There is extreme difficulty with regard to the authority that can be placed in the figures hitherto published of the animal of these corals. Donati (Mer Adriat. 50. t. 7) figures the animal of *Madrepora ramea*, and M. Milne Edwards, who has seen the animal on the coast of Africa, assures us it has nothing resembling the hooked appendages figured by Donati (*Lam. H.* edit. 2. ii. 354). MM. Quoy and Gaimard figure in the Voy. of the Ura-

nia, t. 96, the animal of *Mad. cærulea*, but in the Voyage of the Astrolabe they found that what they had taken for the animals must be parasites, which must have been lodged between the cells, and not what they then regarded as the true animals of the corals. M. Lesueur figures the animal of several species of *Meandrinæ*, but they all differ from the animal which MM. Quoy and Gaimard (Voy. Astrolabe) figure as being the animal of that genus, and both differ from M. Ehrenberg's account of the animal. Lesueur describes *Astræa ananas* as having no tentacles, and Quoy described under the same name a coral that has small rounded tubercle-like tentacles!

Synopsis of the Families.

1. *Animal* 12- *or fewer rayed, with* 12 *or fewer tentacles placed in a single series; coral cells gemmiferous, circumscribed, simple, with* 12 *or fewer longitudinal ridges, and sometimes furnished with a central style.* Les Madrepores, *Blainv.* Phytocorallia dodecactinia, *Ehr.*

Fam. 1. Pocilloporidæ, *Gray, Syn. B. M.* 1842, 130.

Coral hard, solid, brittle, spinulose or granulated; cells 6-sided, simple, shallow, ciliated or spinulose.

Seriatopora, *Lam.* Pocillopora, *Lam.* Stylopora, *Schw.* (Sideropora, *Bl.*, and Anthopora, *Gray.*)

Fam. 2. Stylasteridæ.

Coral minutely porous; cells deep, cylindrical, with six grooves, each ending in a pore and a central style.

Stylaster, *Gray.*

Fam. 3. Madreporidæ, *Gray.*

Coral porous, spongy and rough; cells deep, circular, with six or twelve longitudinal folds, immersed or produced, subcylindrical, and without any central style.

Madrepora, *Lam.* Heliopora, *Bl.* Asteriopora, *Bl.* Montipora, *Bl.* Millepora, *Linn.* (Palmipora, *Bl.*)

Fam. 4. Poritidæ, *Gray.*

Coral very porous, spongy and rough; cells many-sided, with granulose edges, more or less incomplete filamentose or spinulose lamellæ, surrounded by pierced or netted parietes.

Porites, *Lam.* Alveopora, *Bl.*

2. *Animal many-rayed, and with many tentacles, placed in two or more series; coral cells with* 12 *or more radiating plates.* Les Madrepores, *Blainv.* Zoocorallia and Phytocorallia Polyactinia, *Ehrenb.*

a. *Coral cell circumscribed, with only a single centre; laminæ smooth or very slightly serrated; animal gemmiferous.* Ocellina, *Ehr.*

DENDROPHYLLIDÆ.

Coral moderately hard, porous; surface minutely longitudinally striated; cells truncated, concave, generally with a convex centre.

Tubastrea, Dendrophyllia, *Bl.* (Cladocora, *Ehr.*) Explanaria, *Lam.* (Gemmipora, *Bl.*)

OCULINIDÆ.

Coral hard, covered with an enamel surface; cells concave, with radia extended over the edges, or with the outer edge radiately grooved.

Cyathina, *Ehr.* Oculina, *Lam.* Anthophyllum, *Schw.* (A. fasciculatum.)

b. *Coral cells circumscribed or not defined, confluent, with many centres; laminæ serrated and extended, reflexed over the outer surface of the coral, or extended from centre to centre; coral hard, with a hard enamel surface; animal growing by spontaneous division.* Dædalina, *Ehr.*

CARYOPHYLLIADÆ.

Cells deep, round (or sinuous with many centres); laminæ torn, serrated, with a sinuous twisted centre, and often with intermediate smaller plates not reaching the centre; animal continuing to grow upwards and gradually to expand in diameter.

Caryophyllia, *Lam.* (Lobophyllia, *Bl.*) Tridacophyllia, *Bl.* Manicina, *Ehr.* Dipastrea, *Bl.*

MEANDRINIDÆ.

Cells deep, elongate, compressed, with a single series of equal laminæ forming a single linear impressed line in the centre; animal continuing to grow upwards and gradually to expand in diameter.

? Fungia, *Lam.* Flabellum, *Lesson.* Meandrina, *Lam.* Monticularia, *Lam.*

AGARICIADÆ.

Cells shallow, not circumscribed, but scattered and united to one another by laminæ on the star-bearing surface of the coral; animal expanding out laterally, forming a leaf-like frondose coral.

***Agaricia and Pavonia, *Lam.* Stephanocora, *Ehr.* Echinastrea, *Blainv.* ? Astræa, *Lam.*

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

November 11, 1846.—George Gulliver, Esq., F.R.S., in the Chair.

A paper was read entitled "Notes on certain species of birds from Malacca," by H. E. Strickland, F.G.S.

Having lately examined a collection of Malacca birds belonging to the Yorkshire Philosophical Society, comparing them with specimens in my own cabinet, and with the descriptions given by MM. Temminck, Blyth, Eyton and other authors, I have thrown together such remarks as appeared necessary for the elucidation of their characters and synonymy. For some of the identifications of species I am indebted to Mr. Blyth's letters to myself*.

Athene scutulata (Raff.), (*Strix hirsuta*, Temm., *Ninox nipalensis*, Hodgs.)—This is the *Athene malaccensis* of Mr. Eyton, Ann. Nat. Hist., v. xvi. p. 228.

Caprimulgus macrurus, Hors.—Differs from the *C. albonotatus*, Tickell, of India, in its smaller size, being only about 11 inches in total length, wing $7\frac{1}{2}$, tail $5\frac{1}{2}$, and in its darker colour. It appears to be the same as the *C. macrurus* from North Australia figured by Mr. Gould, except in wanting the second white patch seen on the breast in his figure.

Cypselus affinis, Gray.—Rather larger and of a deeper black than Indian specimens, but I do not venture to separate them. Wing $5\frac{1}{4}$ inches, tail $2\frac{1}{8}$.

Ceyx tridactyla, (Pall.)—Much confusion has existed in the synonyms of this and the next species. The present one is distinguished by the whole back and wing-covers being black, each feather terminated with deep blue. It is well-figured by Mr. Jerdon in plate 25 of his 'Illustrations of Indian Ornithology.' It is found in South India and the Malay Peninsula. The following synonyms refer to it:—*Ceyx luzoniensis*, Steph.; *Alcedo purpurea*, Gm.; *A. erithaca*, β. Lath.; *Ceyx microsoma*, Burton; Sonn. Voy. Nouv. Guin., pl. 32; Buff. Pl. Enl., 778. f. 2.; Penn. Gen. Birds, pl. 5.

> Ceyx rufidorsa, Strickland. *C. capite, dorso, tectricibus caudâque totis læte rufis, splendore lilacino variantibus; corpore subtus aurantio-flavo, mento albo, loris et maculâ aurium obscure cæruleo-nigrâ.*

This species, which also occurs at Malacca, is very closely allied to the last, but differs in having the beak larger in all its dimensions, and in having the whole back and wing-covers, as well as the crown, rump and tail, rufous, with a brilliant lilac tint. The dark blue spot on the front and ears is much less marked than in *C. tridactyla*. Lower parts orange-yellow; chin white. This bird was supposed by Pallas, in his 'Spicilegia Zoologica,' part 6, p. 13, to be the female

* Since this paper was written I have seen some rectifications of synonyms by Dr. Hartlaub, Rev. Zool. 1846, p. 1, which nearly agree with those here arrived at.

of *C. tridactyla*. It is figured by Messrs. Jardine and Selby in the 'Illustrations of Zoology,' ser. 1. pl. 55. f. 2. as *C. tridactyla*. Mr. Jerdon, in his 'Illustrations of Indian Zoology,' refers this bird to *Alcedo madagascariensis*, Lin.; but as that bird is distinctly described by the accurate Brisson as having four toes, it must be a true *Alcedo*, and I have therefore given a new specific name to the present bird.

Prionochilus thoracicus, (Tem.), Pl. Col. 600. f. 1.—Temminck's specimens were from Borneo, an island which has but few species in common with the peninsula of Malacca. This is closely allied to *P. percussus*, which I adopted as the type of my genus *Prionochilus*. This genus is very near to *Dicæum*, and has the stoutest and shortest beak of all the *Nectariniidæ*. Many systematists would place it near *Pipra* or *Pardalotus*, but the finely serrated mandibles point out its true affinities.

Dicæum chrysorrhæum, Tem. Pl. Col. 478.—Judging from the similarity of plumage in the young of *Prionochilus percussus*, I suspect that this bird is either the female or young of some other species of *Dicæum*.

Phyllornis moluccensis (Gray), Zool. Misc.—This is the *P. malabaricus* of Tem. Pl. Col. 512. f. 2. and of Blyth, Journ. As. Soc. Beng. 1843, p. 957, but is not the true *malabaricus* of Sonnerat and Scopoli, which has been rediscovered in South India by Mr. Jerdon, and is a larger bird, with the head green and the forehead orange. The last is the *P. cæsmarhynchus* of Tickell. In *P. moluccensis* the whole top and sides of the head are a clear yellow, surrounding the black of the chin and throat, and passing into golden yellow on the hind neck. A small spot on each side of the maxilla indigo-blue. Rest of body green; lesser wing-covers azure, primaries and lateral rectrices externally greenish blue. *P. aurifrons* of Nepal differs from both the above in the chin being blue, &c.

Parus flavocristatus, Lafr. (*Melanochlora sumatrana*, Less.; *Crataionyx ater*, and *flavus*, Eyton; *Parus sultaneus*, Hodgs.)—One of the Malacca specimens is fully as large and as long-crested as Mr. Hodgson's Nepal ones. This is a perfectly typical *Parus*, and is the largest species which I know except the so-called *Oreoica cristata* of Australia, which I also consider a true *Parus*.

Pitta cyanura, Gm. (*M. affinis*, Horsf.)—An immature specimen; exhibits plain blue feathers in various parts of the abdomen, which appear to be supplanting the barred black and rufous feathers commonly seen in this species.

Turdus modestus, Eyton.—One of the specimens before me, probably a fully adult, has the whole throat cinereous brown, and only the tip of the chin white.

Criniger gularis (Horsf.), (*Ixos phæocephalus*, Hartl.; *Trichophorus caniceps*, Lafr.; *Pycnonotus rufocaudatus*, Eyton).—This is a true *Criniger*, though the beak is rather wider than in the type species.

Pycnonotus cyaniventris, Blyth, Journ. As. Soc. Beng. (*Malacopteron aureum*, Eyton).—The smallest species of *Pycnonotus* with

which I am acquainted. Mr. Blyth makes it the type of his genus *Ixidia*.

Pycnonotus melanocephalus (Gm.), (*Ixos atriceps*, Tem. Pl. Col. 147.)—This seems to be the *Ixos metallicus* of Mr. Eyton, in which case the length, eight inches, assigned by him (Ann. Nat. Hist. v. xvi. p. 228), is probably a misprint, as the specimens before me hardly exceed six inches.

Pycnonotus crocorrhous, Strickl., Ann. Nat. Hist. v. xiii. p. 412.—A specimen before me has the vent pale scarlet, and is evidently the *Hæmatornis chrysorrhoides*, Lafr., Rev. Zool. 1845, p. 367, but is otherwise identical with that formerly described, in which the vent is ochreous-yellow. These differences may be sexual. It differs from *Pycnonotus hæmorrhous* of Southern India in having the ear-covers and lower parts nearly white, and in other respects.

Myiagra pyrrhoptera (Tem.), Pl. Col. 596. f. 2. (*Muscipeta plumosa*, Blyth; *Philentoma castanea*, Eyton.)—This bird is intermediate between *Myiagra* and *Muscipeta*, but the development of the uropygial feathers alluded to by Mr. Eyton is hardly sufficient to form a generic distinction. It is probable that the long downy feathers of the lower back and rump, which admit of being expanded laterally, like an umbrella, over the wings, and which we meet with in many distinct groups of tropical Insessores, as the *Formicariinæ* of America, the *Laniariinæ* of Africa, and the *Pycnonotinæ* and *Timaliinæ* of Asia, may be a provision of nature against the violent and long-continued rains of the torrid zone. The species of Flycatcher before us, and the one which follows, may, from their mode of life or geographical distribution, be more exposed to rain than the other species of *Myiagra*, and may be provided with extra clothing accordingly.

Myiagra pectoralis, Lord Arthur Hay in Madras Journ., March 1846.—This is another species, in which the dorsal and hypochondrial feathers are lengthened and thickened, even to a greater degree than in the last. The whole plumage is uniform plumbeous blue, except the lores and chin, which are blackish; the flanks, which are streaked with whitish; and the inner webs of the remiges and rectrices, which are black. Beak and legs black, the former strong, the rictal bristles reaching two-thirds of its length. The first three remiges graduated, the fourth and fifth equal. Total length, $7\frac{1}{2}$ inches; beak to front, 7 lin.; to gape, 11 lin.; height, $2\frac{1}{2}$ lin.; breadth, $4\frac{1}{2}$ lin.; wing, 3 in. 10 lin.; medial rectrices, $3\frac{1}{2}$ in.; external ditto, 3 in. 5 lin.; tarsus, 7 lin. A younger specimen is marked with rufous on the wing-covers, abdomen and lower tail-covers. According to Lord A. Hay, the above-described is the female, the male having the breast claret-coloured, a state of plumage which I have not seen.

PERICROCOTUS MODESTUS, Strickland. *P. corpore supra cinereo subtus albo, remigibus atris, primariis 5 ad 9 et secundariis omnibus fasciâ subbasali albâ; rectricibus atris, albo largè terminatis.*

Above uniform cinereous; front whitish; lores black; remiges blackish, the medial portion of their inner webs white; the fifth to

ninth primaries and all the secondaries with a sub-basal white bar on the outer webs; rectrices blackish, largely tipped with white; chin and lower parts white. Length, 8 inches; beak to front, $5\frac{1}{2}$ lines; to gape, 9 lines; breadth, 3 lines; wing, $3\frac{3}{4}$ inches; medial rectrices, $3\frac{1}{2}$ inches; external ditto, $1\frac{1}{2}$ inch; tarsus, 8 lines; middle toe and claw, 8 lines; hind ditto, 5 lines.

This is a typical species, but is at once distinguished from all the other known species of *Pericrocotus* by the absence of red or yellow in the plumage.

Dicrurus malabaricus, Scop. (*D. rangoonensis*, Gould; *D. retifer*, Tem.)—Racquet-tailed *Dicrurus*, with a very short erect frontal crest.

Dicrurus balicassius (*D. affinis*, Blyth).—This seems to be the true *balicassius* of Linnæus, judging from Brisson's description, though I have never seen a specimen from the Philippine Islands to compare with the Malacca bird.

Lanius lucionensis, Lin.—Having now examined many specimens from the Philippines, Malacca and British India, I find so many variations in the rufous tint of the upper parts, the amount of white on the forehead, and the size of the beak, that I am compelled (contrary to my former opinion, Ann. Nat. Hist., v. xiv. p. 44) to regard them as forming one widely-spread and variable species. The Malacca specimens exhibit a considerable amount of variation in the size of the beak, and the Philippine ones are generally less rufous than those from India. If this view of specific identity be correct, *Lanius cristatus*, Lin.; *L. superciliosus*, Lath.; *L. phœnicurus*, Pallas; *L. magnirostris*, Bélanger; *L. melanotis*, Valenciennes; *L. ferrugiceps*, Hodgson; and *L. strigatus*, Eyton, will all stand as synonyms of *Lanius lucionensis*, Lin.

Eupetes macrocercus, Tem.—This form appears to belong to the subfamily *Timaliinæ*, a group chiefly confined to the Malasian archipelago and the peninsula of Malacca, and which seems to me to include the following genera: *Timalia* proper, *Brachypteryx*, *Malacopteron*, *Macronus*, and one or two others. They are distinguished by great density of plumage, especially on the rump, a more or less shrike-like beak, well-developed legs, and a coloration in which rufous and brown predominate. Little is known of their habits, but they probably form a subfamily of the *Laniidæ*, and may be placed next to *Formicariinæ*, in which most of the South American *Thamnophili* and Antcatchers should be included.

Malacopteron olivaceum, Strickland. *M. supra olivaceo-brunneum, remigibus fuscis, extus rufo-brunneo, intus albido marginatis; rectricibus rufo-brunneis, rufo marginatis; loris superciliisque cinerascentibus, mento et gulâ sordide albidis, pectore lateribusque pallide olivaceis, abdomine pallide fulvo, crisso pallide rufo.*

Upper parts olive-brown; remiges fuscous, edged externally with reddish brown and internally with whitish; tail reddish brown, mar-

gined externally with rufous. Lores and streak over eye greyish; chin and throat dirty white; breast and sides pale olive-brown; belly pale fulvous; vent and lower tail-covers light rufous; upper mandible fuscous, lower yellowish; feet and claws yellowish brown. Total length, 6 inches; beak to front, 10 lines; to gape, 1 inch; height, 3 lines; breadth, $3\frac{1}{2}$ lines; wing, 2 inches 10 lines; medial rectrices, $2\frac{1}{4}$ inches; external ditto, 2 inches; tarsus, 1 inch; middle toe and claw, 11 lines; hind ditto, 9 lines.

Malacopteron macrodactylum, Strickland in Ann. Nat. Hist., v. xiii. p. 417.—Since described as *Brachypteryx albogularis* by Dr. Hartlaub, Rev. Zool. 1844, p. 401. It is however a true *Malacopteron*, which genus differs from the type of *Brachypteryx* by its shorter legs and by the beak, in which the shrike-like form is developed to the greatest extent of all the *Timaliinæ*. *Brachypteryx sepiaria* of Horsf. is a *Malacopteron**.

Timalia pectoralis, Blyth (= *Malacopteron squamatum*, Eyton).

Timalia nigricollis, Tem. Pl. Col. 594. f. 2. (*Brachypteryx nigrogularis*, Eyton; *Timalia erythronotus*, Blyth).—This is a typical *Timalia*.

Timalia erythroptera, Blyth, Journ. As. Soc. Beng. (*Timalia pyrrhophæa*, Hartl.; *Brachypteryx acutirostris*, Eyton).—A true *Timalia*.

Amadina acuticauda, Hodgs. in Asiatic Researches, v. xix.—A well-marked species intermediate between *A. striata*, Lin., and *A. punctularia*, Lin.

Agapornis? malaccensis, Lath. sp.—In the descriptions hitherto given of this bird no mention is made of the deep brownish red feathers on the radial margin of the wing. Mr. Blyth makes of this bird his genus *Psittinus*.

Tiga Rafflesi, Vig.—The only description which I can find of this curious bird is in the classified list given by Mr. Vigors of the animals of Java and Sumatra, published in the Appendix to the edition of the 'Life of Sir Stamford Raffles.' As few persons think of looking into a biographical work for a treatise on zoology, this paper is less known than it deserves to be, and I therefore extract the diagnosis given by Mr. Vigors of the species before us:—

> Picus rafflesi, Vig., l. c. p. 669. P. supra flavescenti-brunneus, subtus brunneus; capite coccineo; gulâ pallide ferrugineâ; strigis, unâ ab oculis, secundâ a rictu extendentibus maculisque ad latera abdominis albis; strigis duabus ad latera genarum, alterâ parvâ superciliari; remigibus rectricibusque nigris.

The specimen before me is a female, and has the crown and elongated crest-feathers wholly deep black; the upper parts are yellowish olive and the lower olive-brown; all the remiges have three round white spots on the inner webs of each; the lower wing-covers are pale yellowish, margined with brown. In all other respects the bird agrees with the description above-quoted. Its total length is $10\frac{1}{2}$

* Mr. Blyth makes my *M. macrodactylum* the type of his genus *Turdinus*, but I cannot approve of genera founded on such very slight distinctions.

inches; beak to front, $1\frac{1}{4}$ inch; to gape, $1\frac{1}{2}$ inch; wing, $5\frac{1}{2}$ inches; medial rectrices, $4\frac{3}{4}$ inches; external ditto, $2\frac{1}{2}$ inches; tarsus, $10\frac{1}{2}$ lines; middle toe and claw, 13 lines; reversed ditto, 10 lines; hind-toe entirely wanting.

The beak is of moderate length, the culmen nearly straight, the gonys ascending, the apex compressed, a slight but distinct ridge running parallel to the culmen, and the nostrils are covered with incumbent feathers. As the *Tiga tridactyla* resembles in its style of plumage the orange-backed woodpeckers, *Brachypternus* and *Chrysocolaptes*, so the more uniform coloration of this species calls to mind the green woodpeckers which form the typical *Gecini*. But the beak is stronger and more adapted for chopping wood than in the latter group, and resembles more the structure of that organ in the red-winged and yellow-crested *Gecini*, such as *G. nipalensis* (Gray), *G. mentalis* (Tem.), &c.

Tiga tridactyla.—Identical with specimens sent by Mr. Jerdon from Madras, except in being smaller. The wing measures only 5 inches, while in the Madras ones it is $5\frac{3}{4}$ inches. Mr. Blyth has already noticed this distinction, but I cannot consider it as a specific one.

Hemicercus rubiginosus, Swains. Birds W. Af. v. 2. p. 150. (*Picus rubiginosus*, Eyton.)

Hemicercus concretus (Tem.), Pl. Col. 90. (*Dendrocopus sordidus*, Eyton.)

Cuculus Sonnerati, Lath.—This species, which occurs also in Southern India, appears never to assume a typically adult plumage, being invariably barred with brown and rufous above, and brown and white below.

CENTROPUS RECTUNGUIS, Strickland. *C. corpore nitide cæruleo-nigro, alis rufis, primariis fusco terminatis, ungue hallucis subbrevi, recto.*

Body and tail glossy black, with a deep blue tint on the head, neck and breast; wings wholly rufous, the primaries slightly tipped with fuscous; hind-claw short and straight. Total length, 14–15 inches; beak to front, $1\frac{1}{4}$ inch; to gape, $1\frac{1}{2}$ inch; height $\frac{1}{2}$ inch; width, $\frac{1}{2}$ inch; wing, 6 inches; medial rectrices, $7\frac{1}{2}$ inches; external ditto, $6\frac{1}{4}$ inches; tarsus, $1\frac{3}{4}$ inch; claw of hind-toe, $\frac{1}{2}$ inch. Nearly allied in size, form of beak and coloration to *C. philippensis*, Buff. Pl. Enl. 824. (*C. bubutus*, Horsf.) of India, Java and the Philippines; but differs in the shorter wings and tail, and in the hind-claw being almost perfectly straight, and only half an inch long; while in *C. philippensis* (sent by Mr. Jerdon from Madras) this claw is three-quarters of an inch long and considerably curved; the wing measures $7\frac{1}{2}$ inches and the tail 10 inches.

Treron Capellei (Tem.), Pl. Col. 143.—The largest of the genus, and erroneously named *militaris*, in many museums. I inadvertently described this as new, under the name of *magnirostris* in the Ann. Nat. Hist., v. xiv. p. 116.

Treron fulvicollis (Wagl.), (*T. tenuirostre*, Eyton.)

Rollulus niger.—The female of this bird has been described by Mr. Vigors under the name of *Cryptonyx ferrugineus*, and by Mr. Eyton as *Perdix æruginosus* (Proc. Zool. Soc. part 7. p. 106). It departs from the type of *Rollulus* in possessing a rudimentary hind claw.

Turnix pugnax, Tem. Pl. Col. 60. f. 2.—This seems to be the *Hemipodius atrogularis* of Mr. Eyton, Proc. Zool. Soc. part 7, p. 107.

Rallus striatus, Lin. (*Rallus gularis*, Horsf., Blyth, &c.)—I have specimens of this species from the Philippine Islands, Malacca and Madras, which present no specific difference, and which exactly agree with Brisson's description of his *Rallus philippensis striatus*, on which *R. striatus*, Lin., is founded.

November 24.—William Yarrell, Esq., Vice-President, in the Chair.

Mr. Gould exhibited to the Meeting, named and described three Australian Birds collected by the late Mr. Gilbert, viz. :—

Petroica superciliosa. *Pet. strigâ superciliari, gulâ, abdomine, et humeris infrà, albis; loris, auribus, et alarum tectricibus, atris; primariis et secondariis, ad basin albis, ad mediam intensè atris; alis, caudâque fuligineis; rectricibus, intermediis duabus exceptis, ad apices albis.*

Superciliary stripe, throat, abdomen, under surface of the shoulder, and the base of the primaries and secondaries white; lores, ear-coverts, wing-coverts, and the primaries and secondaries for some distance beyond the white, deep black; all the upper surface, wings, and tail, sooty-brown; all but the two central tail-feathers largely tipped with white; bill and feet black; irides reddish brown.

Total length 5 inches; bill, $\frac{3}{4}$; wing, 3; tail, $2\frac{1}{2}$; tarsi, $\frac{7}{8}$.

Hab. The neighbourhood of the Burdekin Lakes, in the interior of Australia.

Poëphila leucotis. *Poë. vittâ in fronte, loris, gulâque, et maculâ magnâ quoque in latere, intense holosericis nigris; auribus, lineâ attenuatâ nigrum in gulâ colorem infrà marginante, et spatio maculam in latera circumdante, albis; vertice, omni superiore corpore, alisque, saturatè cinnamomeis; pectore, et abdomine, pallidè vinosis; tectricibus caudæ superioribus inferioribusque albis.*

Band crossing the forehead, lores, throat, and a large patch on each flank, deep velvety black; ear-coverts, narrow line beneath the black of the throat, and a space surrounding the black patch on the flanks, white; crown of the head deep reddish chestnut; all the upper surface and wings dark cinnamon-brown; chest and abdomen pale vinous brown; upper and under tail-coverts white, the former margined externally with deep black; tail black; irides dark brown; feet red; bill yellowish horn-colour.

Total length, $4\frac{3}{8}$ inches; bill, $\frac{3}{8}$; wing, $2\frac{1}{4}$; tail, $2\frac{1}{4}$; tarsi, $\frac{5}{8}$.

The female is somewhat smaller and not quite so brightly coloured.

Hab. The neighbourhood of the river Lynd, in the interior of Australia.

Remark.—Nearly allied to *P. personata*.

Climacteris melanotus. *Cli. strigâ superciliari, gulâque, albo-cervinis; lineâ ante oculum, alterâ post oculum, omni superiore corpore, alis, caudâque, saturatè fusco-nigris; primariis, secondariis, tertiariisque ad basin, et humeris infrà stramineis; corpore inferiore vinoso; singulâ abdominis plumâ lineis duabus spatium album marginantibus nigris longitudinaliter prope caulem ornatâ.*

Superciliary line and throat buffy-white; line before and behind the eye, all the upper surface, wings, and tail, dark brownish black; the base of the primaries, secondaries, and tertiaries, and the under surface of the shoulder buff; under surface pale vinous brown; the feathers of the abdomen with two stripes of black running parallel to and near the stem, the space between dull white; at the base of the throat several irregular spots of black; under tail-coverts buffy-white, crossed by broad bars of black; irides brown.

Total length, $5\frac{1}{2}$ inches; bill, $\frac{3}{4}$; wing, $3\frac{1}{2}$; tail, $2\frac{1}{2}$; tarsi, $\frac{7}{8}$.

The female differs in having the markings of the abdomen larger and more conspicuous, and in having the spots at the base of the throat chestnut instead of black.

Hab. The neighbourhood of the river Lynd, in the interior of Australia.

Remark.—Nearly allied to *C. melanura* and *C. scandens*.

MICROSCOPICAL SOCIETY.

Nov. 11, 1846.—J. S. Bowerbank, Esq., F.R.S., President, in the Chair.

A paper was read by Mr. John Quekett, entitled "Additional Observations on the intimate Structure of Bone."

The author, after alluding to a previous paper on the same subject read before the Society in March last, in which he described certain characters peculiar to the bones of each of the four great classes of the vertebrate kingdom, by which a bone of each class could be easily distinguished, and after pointing out the importance of the knowledge of this subject to the palæontologist and geologist in enabling them to determine the nature of any fossil fragment of bone however minute, went on to state that he had ascertained that the cells of the bone bore a certain relation in point of size to that of the blood-discs; thus for instance the blood-discs were found to be largest in reptiles, smallest in birds and mammalia, and were in fishes of an intermediate size; and he had discovered that the bone-cells followed the same law. In the present paper Mr. Quekett stated the results of his examination of the structure of the bone of the perennibranchiate reptiles, viz. the Syren, Proteus and Axolotl, which have the largest blood-discs of all the vertebrata; and he found that in them the bone-cells were the largest also, which fully bore out and confirmed his former statement. Diagrams were exhibited which represented the bone-cells in the human subject, the Ostrich, Turtle, Syren and Lepidosteus, when magnified 450 diameters, by which means their characteristic differences were rendered very evident.

A second paper by John King, Esq., Ipswich, was read, "On a

Method by which all objects may be polarized under the Microscope."

The analyser consists of a double image prism placed over the eye-piece of the instrument, and a plate of selenite is then put upon the stage; the edges of the field will then appear coloured, while the centre remains colourless. Any object introduced into the field will exhibit the effects of polarized light with great intensity and purity of colour.

MISCELLANEOUS.

ADDENDUM TO THE BIRDS OF CORFU.

Platalea leucorodia, the Spoonbill or White Spoonbill.

Corfu, Nov. 15, 1846.

THIS bird, according to Yarrell, is still an occasional summer visitor in England, has been noticed by Mr. Robert Ball in Ireland, by Mr. Eyton in Wales, and by Sibbald and Fleming in the Scottish islands. Of the northern regions its favourite summer resort is Holland, and Temminck says that it is nowhere so abundant as there. In winter it seeks a warmer abode, and flocks amongst other southern localities to the salt-marshes or sea-coast of Italy, being specially abundant, says Temminck, at Cagliari in Sardinia. In these islands the naturalist has not as yet recorded the Spoonbill, and the occurrence of the present bird, the young of the year, is therefore highly interesting, as offering another line or belt of migration. I received the bird with the blood quite fresh upon it on the 31st of October, and therefore conclude it was shot in the island itself. I was unable to ascertain from the bird-dealer (not the sportsman) who brought it whether others had been seen, but I conclude, as the bird was one of the year, or at least an immature bird, as shown by the beak and quill-feathers, and by the absence of elongated occipital feathers, that it was not alone in its flight.—J. E. PORTLOCK.

Corfu, Nov. 23, 1846.

Platalea leucorodia. On inquiry I find that the Spoonbill recorded by me as appearing at the close of October was one of a flock of about seven birds, three of which, all immature, like the one noticed by me, were shot. Signor Gangadi informs me, that though rare at Corfu it has been occasionally observed, and that he believes it appears every season on the Albanian coast. It is recorded amongst the Dalmatian birds by Dr. Carrara in his work 'Dalmazia descritta' now publishing.

I observe also in Dr. Carrara's work, *Aquila nævia*, *Ardea comata*, *Sterna leucoptera*, birds added by me to the former list of Corfu birds. —J. E. PORTLOCK.

ACHILLEA TANACETIFOLIA, ALL.

This beautiful plant has been recently added to the list of British species by Mr. John Hardy. He has found it in two places, as he considers, indubitably indigenous and not an escape from cultivation,

viz. on "Cromford Moor near Matlock, Derbyshire, July 21, 1843," and on "a rough hilly bank near Ringing Low, five miles from Sheffield, July 1844; the plant accompanied by *Vaccinium Vitis-Idæa*, &c., and growing among a profusion of *Lastræa oreopteris*." It is the *A. dentifera* (DeCand. Prod. vi. 25), but that is not separated from *A. tanacetifolia* by many, of which it seems to be only a variety.—C. C. B.

On the Characters separating the four great Divisions of the Animal Kingdom. By J. E. Gray, F.R.S.

Great attention has been paid to the anatomical character which separates the four great divisions of the animal kingdom, but comparatively little attention has been paid to the external form of the groups and the characters furnished by their supports.

Form and Limbs.	Supported
Vertebrata with two pair: two on each side of the body for walking or flight. Organs of sense in pairs.	by a permanent internal cartilaginous skeleton hardened by age, and restored and removed by the vessels like the rest of the body.
Annulosa with five pair: five on each side of the body, for creeping or flight. Organs of sense in pairs.	by a hardened external skin which is periodically shed.
Mollusca: a single central foot for crawling. Organs of sense in pairs.	by two lateral shelly valves* secreted by the skin and attached to the body by muscles.
Radiata: a circular free or attached body. The organs of sense in a circle.	by horny or calcareous matter deposited in the entire or superficial part of the cellular substance of the body, part of which is often killed by the excess of the deposit.

ON THE GENUS CALOPTYLUM.

To Richard Taylor, Esq.

Haslar Hospital, Gosport, January 12, 1847.

Dear Sir,—In the Ichthyology of the voyage of the 'Sulphur' I described a fish from the collection of Sir Edward Belcher which I then considered to be the type of a new genus under the name of *Caloptylum*. Mr. Thompson lately called my attention to the *Bregmaceros MacClellandi* published by him in the fourth volume of your 'Annals,' p. 184 (April 1840), which is evidently of the same genus, but most probably another species. *Bregmaceros* is therefore the prior generic appellation. I remain, faithfully yours,

John Richardson.

* The second valve is sometimes reduced to the form of a lid or operculum, and sometimes entirely wanting, but is often found in the fœtal state when wanting in the adult animal.

THE TEIN-CHING, OR CHINESE INDIGO.

When in the north of China my attention was directed to a plant largely cultivated by the inhabitants for the sake of its blue dye. In the southern provinces a considerable quantity of indigo (*Indigofera*) is cultivated and manufactured, besides a large portion which is annually imported from Manilla and the Straits. In the north, however, the plant which we call indigo is never met with—owing, I suppose, to the coldness of the winters—but its place is supplied by this *Isatis indigotica*, or the "*Tein-ching*," as it is called by the Chinese. I met with it in the Nanking cotton district, a few miles west from Shanghae, where it is considered a plant of great importance, and covers a large tract of country. It is grown in rows a few inches apart, and at a distance looks like a field of young turnip or cabbage plants. In June 1844, when I was in that country, the plants were from 6 inches to 1 foot in height, and being considered in perfection, the natives were busily employed in cutting them and removing them to the manufactory. One of these places which I inspected was close on the banks of the canal, and was placed there for the convenience of the farmers, who brought their leaves in boats from the surrounding country, as well as to be near the water, a large quantity of which was requisite in the manufacture. It consisted of a number of round tanks, which are built for the purpose of steeping the leaves. The leaves are thrown into the tanks and covered with water, and, after remaining for a certain length of time, the juice is drawn off into other tanks, where I believe it is mixed with lime. The colour of the liquid at first is a kind of greenish blue, but after being well stirred up and exposed to the air it becomes much darker and very like the well-known indigo of commerce. I suppose it is thickened afterwards by evaporation in some way, but that part of the process did not come under my observation. I am very much inclined to believe that this is the dye used to colour the green teas which are manufactured in the north of China for the English and American markets; this, however, is only conjecture. The plant has a half-shrubby stem covered with a fine bloom. Its root-leaves are oval-lanceolate, on long stalks, sharp-pointed, slightly toothed, and somewhat fleshy; those on the upper part of the stem, near the flowers, are linear. The stem is decumbent, a foot and a half long, and divided at its extremity into several drooping racemes about 6 inches long; on its sides it bears here and there small clusters of leaves like those of the root. Flowers very small, yellow. Silicles black, quite smooth, 6 lines long by 2 wide in the broadest part, oblong, obtuse at each end, a little contracted below the middle, with a thin edge and a single median line.—*Fortune, in Journal of the Horticultural Society.*

M. SCHÖNHERR.

M. Schönherr the celebrated Swedish entomologist has had a distinguished mark of royal favour conferred upon him in November last by being made Knight Commander of the Royal Order of Wasa, having previously in 1829 by the late King of Sweden been made Knight of the Royal Order of the Polar Star.

On the Minhocão of the Goyanese. By M. Auguste de Saint-Hilaire*.

Luiz Antonio da Silva e Souza, whose acquaintance I made during my travels, and to whom we owe the most valuable researches on the history and statistics of Goyaz, says, in speaking of the lake of Padre Aranda, situated in this vast province†, that it is inhabited by minhocôes‡; then he adds that these monsters—it is thus he expresses himself—dwell in the deepest parts of the lake, and have often drawn horses and horned cattle under the water§. The industrious Pizarro, who is so well acquainted with all that relates to Brazil, mentions nearly the same thing, and points out the lake Feia, which is likewise situated in Goyaz, as also being inhabited by minhocôes‖.

I had already heard of these animals several times, and I considered them as fabulous, when the disappearance of horses, mules and cattle, in fording the rivers, was certified by so many persons, that it became impossible for me to doubt it altogether.

When I was at the Rio dos Pilôes, I also heard much of the minhocôes; I was told that there were some in this river, and that at the period when the waters had risen, they had often dragged in horses and mules whilst swimming across the river.

The word *minhocão* is an augmentative of *minhoca*, which in Portuguese signifies *earth-worm*; and indeed they state that the monster in question absolutely resembles these worms, with this difference, that it has a visible mouth; they also add, that it is black, short, and of enormous size; that it does not rise to the surface of the water, but that it causes animals to disappear by seizing them by the belly.

When, about twenty days after, having left the village and the river of Pilôes, I was staying with the Governor of Meiapont, M. Joaquim Alvez de Oliveira, I asked him about these minhocôes: he confirmed what I had already been told, mentioned several recent accidents caused by these animals, and assured me at the same time, from the report of several fishermen, that the minhocão, notwithstanding its very round form, was a true fish provided with fins.

I at first thought that the minhocâo might be the *Gymnotus Carapa*, which according to Pohl¶ is found in the Rio Vermelho, which is near to the Rio dos Pilôes; but it appears from the Austrian writer that this species of fish bears the name of *Terma termi* in the country; and moreover the effects produced by the Gymnoti are, according to Pohl, well-known to the mulattos and negroes who often felt them, and have nothing in common with what is related of the minhocâo. Professor Gervais, to whom I mentioned my doubts, directed my attention to the description which P. L. Bischoff has given of the

* This notice is taken from an unpublished work on the province of Goyaz.

† The province of Goyaz stretches from nearly 5° 22′ lat. south to the 22nd degree, and is greater than France.

‡ Plural of minhocâo.

§ See Memoria sobre o descobrimente, etc. da capitania de Goyaz in the 'Patriota,' 1814.

‖ Memorias Historicas, etc., vol. ix. p. 332.

¶ Reise, vol. i. p. 360.

*Lepidosiren**; and indeed the little we know of the minhocão agrees well enough with what is said of the rare and singular animal discovered by M. Natterer.

That naturalist found his *Lepidosiren* in some stagnant waters near the Rio da Madeira and of the Amazon: the minhocâo is not only said to be in rivers, but also in lakes. It is, without doubt, very far from the lake Feia to the two localities mentioned by the Austrian traveller; but we know that the heats are excessive at Goyaz. *La Serra da Paranahyba e do Tocantim*†, which crosses this province, is one of the most remarkable dividers of the gigantic water-courses of the north of Brazil from those of the south; the Rio dos Pilôes belongs to the former, as does the Rio da Madeira. The *Lepidosiren paradoxa* of M. Natterer has actually the form of a worm, like the minhocâo. Both have fins; but it is not astonishing that they have not always been recognized in the minhocâo, if, as in the *Lepidosiren*, they are in the animal of the Rio dos Pilôes reduced to simple rudiments. "The teeth of the *Lepidosiren*," says Bischoff, "are well-fitted for seizing and tearing its prey; and to judge of them from their structure and from the muscles of their jaw, they must move with considerable force." These characters agree extremely well with those which we must of necessity admit in the minhocâo, since it seizes very powerfully upon large animals and drags them away to devour them. It is therefore probable that the minhocâo is an enormous species of *Lepidosiren*; and we might, if this conjecture were changed into certainty, join this name to that of the minhocâo to designate the animal of the lake Feia and of the Rio dos Pilôes. Zoologists who travel over these distant countries will do well to sojourn on the borders of the lake Feia, of the lake Padre Aranda, or of the Rio dos Pilôes, in order to ascertain the perfect truth—to learn precisely what the minhocâo is; or whether, notwithstanding the testimony of so many persons, even of the most enlightened men, its existence should be, which is not very likely, rejected as fabulous.—*Comptes Rendus*, Dec. 28, 1846.

AWARD OF MEDALS.—LINNÆAN SOCIETY.

A Special General Meeting of this Society was held on Friday the 8th of January, to consider the subject of the following Statement and Resolution of Council relative to the Bequest of the late Edward Rudge, Esq., F.L.S.

The Council, after much patient and anxious deliberation, had unanimously come to the following resolution:—

"Resolved,—That in the opinion of this Council, on a full consideration of the terms of the bequest of the late Edward Rudge, Esq., of the interest of a sum of £200, for the purpose of establishing a Medal 'to be awarded by the President and Council of the (Linnæan) Society, at their discretion, to the Fellow of the said Society who shall write the best communication in each volume which after his (the testator's) decease shall be published by the said Society, in

* Annales des Sciences Naturelles, 2me série, tom. xiv. p. 116.

† In an article on the whole of the mountains of Brazil, I shall make known the portion of the chain which should bear this name.

either of the four departments of Natural History,' it is inexpedient to accede to the liberal intentions of the testator under the conditions expressed in his will."

This Resolution, which received the entire concurrence of the President and of every Member of the Council, was chiefly founded on the following considerations:—

The great object of the Linnæan Society, as of all other bodies similarly constituted, is the production and publication of such essays as tend to the advancement of that branch of science which it cultivates. The principal question therefore in reference to Mr. Rudge's bequest, is the manner in which its acceptance would operate on the Society's publications, and the Council has arrived at the conclusion that its tendency would be prejudicial rather than favourable; inasmuch as while the Medal would offer no inducement to some of those Members who have hitherto been in the habit of communicating papers which have had a place in the 'Transactions,' they might, on the contrary, be unwilling to submit their future communications to this new ordeal; and it does not appear probable that the Medal would prove a stimulus to the production of more valuable Essays from any other class of the Society. On the other hand, it is probable that dissatisfaction would arise in the minds of some of those Members, who after contributing papers to more than one volume of the 'Transactions,' should fail in obtaining the award of a Medal.

A second objection to the acceptance of the bequest arises from the absence of any discretionary power of withholding the Medal, which is necessarily to be awarded to the best paper in every volume, and consequently to papers of very unequal value, thereby lowering the character of the Medal, and consequently affecting the scientific reputation of the Society itself.

Differences of opinion, and consequent dissatisfaction, would also be not unlikely occasionally to arise in deciding upon the comparative merits of papers in botany and zoology, the two branches of natural history, of which, for many years past, the Transactions of the Society have exclusively consisted.

Another point may still be noticed as decidedly unfavourable to the acceptance of the bequest, namely, the not improbable award of the Medal by the Council, in some cases to one of its own body, in strict conformity with the conditions of the will; conditions which neither the Council itself, nor (as it appears from the tenor and provisions of the will) any other party has the power to modify.

These objections have appeared to the Council so important as not to admit of any other course but that of respectfully declining to accept a bequest, the operation of which would in all probability be injurious to the best interests of the Society, by lowering the character of its publications, and endangering the continuance of that harmony which has hitherto prevailed in all essential points. The Council is at the same time deeply sensible of the kind and liberal intentions of Mr. Rudge, and entertains a sincere regret that the express terms of his will should have rendered the acceptance of his bequest liable to such grave objections.

The meeting was numerously attended, and the President (the

Bishop of Norwich) having read from the chair the above Statement on the part of the Council, some of the Fellows who had been Members of the Councils of the Royal and Geological Societies stated their opinion of the inconvenience and injurious tendency of the awarding of medals in those Societies, and their inutility for the promotion of science; after which the Resolution proposed by the Council was unanimously approved and adopted.

METEOROLOGICAL OBSERVATIONS FOR DEC. 1846.

Chiswick.—December 1, 2. Foggy. 3. Cloudy: frosty 4. Sharp frost: fine. 5. Cloudy: clear and fine: overcast. 6. Clear: cloudy. 7. Fine: cloudy. 8. Cloudy: fine. 9. Slightly overcast: drizzly: slight rain. 10. Rain. 11. Frosty: snowing: clear and frosty. 12. Frosty: cloudy: clear and frosty. 13. Frosty: cloudy: severe frost at night. 14. Severe frost: clear and frosty throughout. 15. Severe frost: densely overcast: clear and frosty. 16. Sharp frost: clear and cold: frosty. 17. Densely overcast: fine: slight snow. 18. Sharp frost: clear: overcast. 19. Rain: foggy. 20. Rain: cloudy. 21. Rain: clear and frosty at night. 22. Slight frost and fog: fine: clear. 23. Rain. 24. Foggy. 25. Frosty: clear. 26. Clear and frosty. 27. Frosty: cloudy: clear and frosty. 28. Frosty and foggy. 29. Slight frost: overcast. 30. Densely overcast: frost at night. 31. Sharp frost: foggy.

Mean temperature of the month .... 31°·26
Mean temperature of Dec. 1845 .... 40 ·41
Average temperature of Dec. for the last twenty years ...... 40 ·04
Average amount of rain in Dec. .... 1·58 inch.

Boston.—Dec. 1. Fine: snow on the ground. 2. Cloudy: snow on the ground. 3. Fine: snow on the ground. 4. Cloudy: snow on the ground. 5. Fine: snow on the ground: rain P.M. 6. Fine. 7. Rain. 8. Fine: rain P.M. 9. Cloudy: rain P.M. 10. Fine. 11, 12. Snow: snow on the ground. 13—16. Cloudy: snow on the ground. 17. Cloudy: snow early A.M. 18*, 19. Cloudy: snow on the ground. 20. Fine: snow on the ground. 21. Cloudy: snow on the ground. 22. Fine: snow nearly all gone: melted snow. 23. Cloudy. 24. Snow: snow on the ground. 25, 26. Fine: snow on the ground. 27—30. Cloudy: snow on the ground. 31. Cloudy: snow on the ground: melted snow.

Sandwick Manse, Orkney.—Dec. 1. Showers: clear. 2. Bright: sleet-showers. 3. Hail-showers: sleet-showers. 4. Bright: showers. 5. Showers: sleet-showers. 6. Sleet-showers: cloudy. 7. Rain: clear. 8. Drizzle: cloudy. 9. Drizzle: shower: clear: aurora. 10, 11. Snow-showers: snow-drift. 12, 13. Snow-drift: snow-showers. 14. Snow-showers. 15. Snow-showers: snow-drift. 16. Snow-showers. 17. Snow-showers: snow: clear. 18. Thaw: quick thaw. 19. Frost: showers. 20. Bright: clear: hoar-frost. 21. Rain: showers. 22. Hail-showers: frosty. 23. Hail-showers: clear: aurora. 24. Hail-showers: cloudy. 25. Clear: cloudy. 26. Bright: cloudy. 27. Bright: rain. 28. Bright: drizzle. 29. Drizzle: clear. 30. Fine: clear: halo. 31. Drizzle.

Applegarth Manse, Dumfries-shire.—Dec. 1. Thaw. 2—4. Hard frost. 5. Wet. 6. Frost: clear. 7. Frost. 8. Frost, but dull. 9. Frost, slight. 10. Thaw: slight snow. 11—14. Keen frost. 15. Keen frost: slight snow. 16. Keen frost: sleet. 17. Keen frost: slight snow. 18. Frost A.M.: rain P.M. 19—21 Wet. 22. Frost, keen. 23. Frost, keen: slight snow. 24. Frost, keen: more snow. 25, 26. Frost, keen. 27. Thick fog: frost. 28. Thaw: fog: rain. 29. Thaw: thick fog. 30, 31. Thaw: fog.

Mean temperature of the month .... 33°·5
Mean temperature of Dec. 1845 .... 39 ·5
Mean temperature of Dec. for twenty-three years .... 38 ·3
Mean rain in Dec. for eighteen years .... 3 inches.

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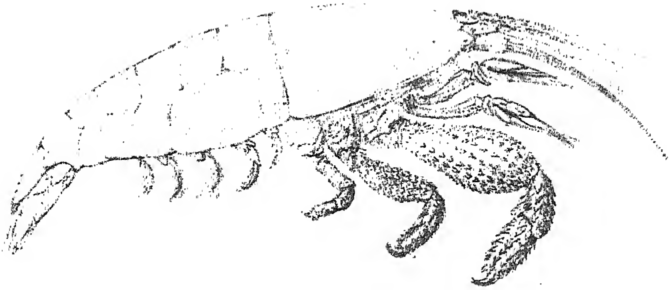
* Not so cold a day in December since 28th December 1829, which was 16°·5. Not so cold a month of December for twenty years at least: December 1829 was very cold—average 33°·1.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse,* Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.							Thermometer.								Wind.				Rain.			
	Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1846. Dec.	Max.	Min.		9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9½ a.m.	8½ p.m.								
1.	29·900	29·655	29·60	29·54	29·48	29·39	29·47	31	25	27	41	27½	40½	38	sw.	calm	nw.	nw.	......	......	......	·38
○ 2.	29·428	29·361	29·27	29·40	29·40	29·40	29·38	36	29	26	33	23½	37	37	nw.	calm	nw.	nnw.	......	......	......	·06
3.	29·716	29·564	29·40	29·50	29·62	29·56	29·78	37	17	27	39½	20	40	36	n.	calm	nw.	n.	......	......	......	·29
4.	29·878	29·788	29·57	29·78	29·86	29·90	29·74	38	25	34	37½	29	38½	42	n.	n.	n.	sw.	......	......	......	·04
5.	30·003	29·821	29·74	29·67	29·50	29·34	29·43	40	29	28·5	43	23	44	38	w.	calm	sw.	nw.	·11	......	......	·27
6.	29·811	29·732	29·52	29·65	29·85	29·72	29·97	41	30	32	40½	32	36	39	nw.	calm	nw.	nnw.	......	·13	......	·40
7.	30·127	29·904	29·70	30·00	30·10	30·04	30·11	42	33	35	40½	34	43	48	n.	calm	nnw.	wnw.	......	·17	......	·17
8.	30·231	30·187	30·00	30·20	30·20	30·22	30·21	42	34	35	39	31	48½	49	ne.	calm	nnw.	w.	......	·10	0·10	·11
9.	30·161	30·084	29·92	30·12	29·98	30·10	29·82	43	33	41	42	36½	48½	47	ne.	calm	nw.	w.	·07	·09	......	·02
☾ 10.	29·904	29·651	29·56	29·63	29·65	29·80	29·72	44	24	40	45½	35½	30	32	sw.	calm	nnw.	n.	·08	·05	......	·08
11.	29·641	29·591	29·33	29·59	29·57	29·67	29·77	44	19	30	32	25	33	32	nw.	n.	nnw.	n.	......	......	......	......
12.	29·741	29·534	29·46	29·67	29·70	29·89	29·93	34	24	32	34	29	33	30½	ne.	calm	n.	n.	......	......	......	......
13.	29·759	29·697	29·54	29·70	29·60	29·80	29·66	30	11	27	33	24	32	32	ne.	calm	nw.	n.	......	......	......	......
14.	29·610	29·486	29·36	29·44	29·37	29·58	29·56	30	13	20	33	18	30	31	w.	calm	nw.	nne.	......	......	......	......
15.	29·571	29·425	29·22	29·40	29·54	29·66	29·70	30	13	25·5	33½	24	32	33½	nw.	nw.	nw.	n.	......	......	0·00	......
16.	29·749	29·678	29·46	29·60	29·50	29·68	29·65	35	21	29	36½	27½	36½	35	nw.	calm	nw.	n.	......	......	......	......
17.	29·739	29·590	29·44	29·55	29·88	29·79	29·97	36	15	28	35½	25	32½	29	nw.	calm	n.	......	......	......	......	......
● 18.	30·166	30·119	29·94	29·91	29·63	29·66	29·55	33	23	18	40	19	39	41	sw.	calm	n-sw.	nw.	·22	......	......	·70
19.	29·851	29·814	29·54	29·56	29·51	29·59	29·40	44	41	37·5	45½	41	35	46	sw.	calm	w.	w.	·04	......	......	·09
20.	29·765	29·655	29·43	29·30	29·26	29·20	29·14	48	42	44	45	41	39½	36	sw.	calm	w.	e.	·07	......	......	·10
21.	29·190	29·004	28·86	28·83	28·83	29·02	29·03	49	25	46	43	40	39	35½	sw.	w.	w.	ne.	·11	......	......	·51
22.	29·125	29·011	28·76	28·93	28·89	29·15	29·16	49	26	35	35	27	33	33½	w.	calm	nw.	e.	·37	·89	......	·25
23.	29·024	28·620	28·60	28·80	28·98	29·23	29·40	39	34	36	38	31	34	31½	ne.	calm	nnw.	ene.	·10	......	0·65	·02
24.	29·332	29·159	29·04	29·22	29·38	29·42	29·52	35	26	34	37½	29½	33	31	e.	calm	nne.	nw.	·04	......	......	......
☽ 25.	30·037	29·593	29·40	29·63	29·93	29·76	29·80	34	19	23	32½	23½	33	43	n.	calm	nnw.	nw.	......	......	......	·08
26.	30·249	30·228	30·00	30·10	30·22	30·10	30·23	37	21	26	41½	24	40	43	nw.	calm	nnw.	w.	......	......	......	·26
27.	30·494	30·396	30·20	30·26	30·24	30·26	30·08	38	23	30	35½	21½	38	40	n.	calm	e.	sw.	......	......	......	......
28.	30·499	30·432	30·26	30·20	30·22	30·12	30·15	34	27	25·5	40	32½	44	44	w.	calm	w.	ssw.	......	......	......	·10
29.	30·505	30·444	30·20	30·19	30·25	30·04	30·21	40	27	32	41	35½	45	45	s.	calm	ne.	wsw.	......	......	......	·04
30.	30·573	30·552	30·32	30·30	30·32	30·24	30·30	32	15	31	39½	34½	42	45½	s.	calm	ene.	sw.	......	......	0·15	......
31.	30·540	30·434	30·32	30·35	30·34	30·37	30·40	28	21	32	40½	36	46½	46½	s.	calm	ene.	sw.	......	·57	......	......
Mean.	29·881	29·744	29·58	29·678	29·703	29·732	29·749	37·84	24·68	31·2	38·5	29·0	37·93	38·40					1·21	2·00	0·90	3·97

1



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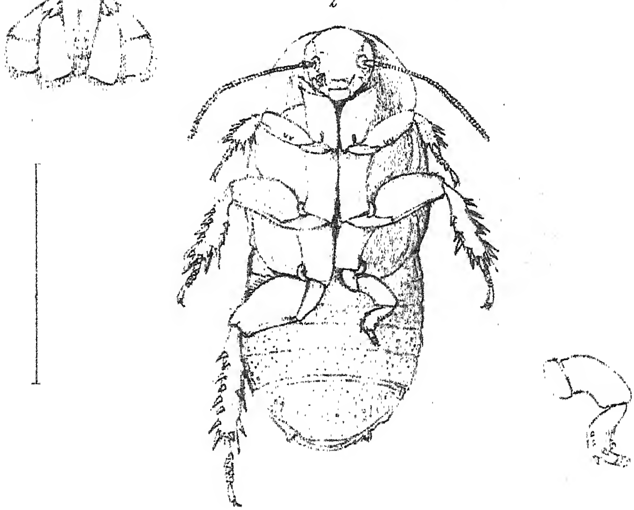

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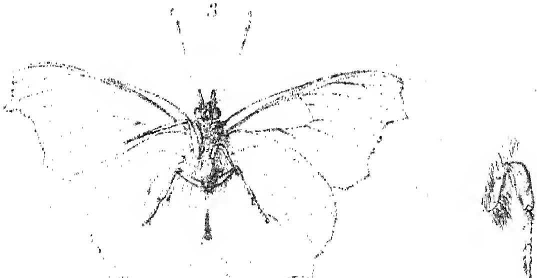


THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

No. 125. MARCH 1847.

XVI.—*On the Reproduction of Lost Parts in the Articulata.* By George Newport, F.R.S. &c.

[With a Plate.]

The reproduction of lost parts in animals is an occurrence of great interest to the physiologist, when considered with reference to the function of nutrition, or with regard to the manner in which the external parts of the body are originally formed. It is desirable, therefore, that we should carefully record every fact that can in any way assist us in explaining the phænomena connected with it, or that tends to verify its occurrence in any particular class.

Naturalists, for a long series of years, have been aware that the Crustacea and Arachnida have a power of reproducing their limbs when the original ones have been accidentally lost or removed, but, until a somewhat recent period, this power was believed to be confined almost entirely to those two classes of the Articulata. It was believed that true insects were not endowed with it, or at most but to a very slight extent.

Beckmann formerly noticed the existence of a leg of diminutive size in *Agrion virgo* *, and Goeze a similar one in *Semblis bicaudata* †; whence the latter naturalist concluded that these were parts which had been reproduced. But no experiments whatever seem to have been made by him, or by any other naturalist, so far as I am aware, to test the question as to whether true insects possess the power of reproducing lost parts, until those which were made by Dr. Heineke ‡. This gentleman's observations however were imperfect, as they were made only on the antennæ of *Blatta* and *Reduvius*. The antennæ of these species were reproduced, but no experiments were made on the legs.

* Physikalisch-œkonomische Bibliothek, vol. iii. p. 20.
† Naturforscher, par. xii. p. 221.
‡ Zoological Journal, vol. iv. p. 422.

Dr. Burmeister indeed, in 1836*, made a general vague statement that mutilated caterpillars are said to obtain new limbs, but his remark was not accompanied by any reference to experiments in support of the fact; while he remarked of insects generally, that they "display but very slight traces of a power of reproduction." Subsequently to this, Professor Müller, in the excellent English edition of his 'Physiology' by Dr. Baly in 1837, stated that the larvæ of insects reproduce their antennæ, and that those of *Phasma* also reproduce their legs†. No observations had yet been made to show that any of the Myriapoda possess this power, until a specimen of *Scolopendra subspinipes* with the eleventh leg on the left side extremely diminutive, was exhibited by myself at a meeting of the Entomological Society in November 1839, and pointed out as an instance of reproduction in that class. In the following February the Rev. F. W. Hope exhibited an Australian *Scolopendra* with one of the posterior legs very diminutive, and which, with me, he regarded as a structure that had been reproduced. This view was strongly objected to by Mr. J. Obadiah Westwood, the entomologist, who contended that these were only instances of retarded development; and he maintained this opinion with much perseverance. In November 1840 the same gentleman produced to the Society, in support of his assumption, a specimen of *Lithobius* with a diminutive posterior leg, which he regarded as an instance of retarded development, and not as one of reproduction.

As the promulgation of erroneous opinions is a matter of serious import to science, more especially when sheltered by apparent facts, I endeavoured to put these opinions and my own views to the test of experiment. Accordingly, I instituted a series of experiments on the Myriapoda, both on the Chilognatha in 1841 and on the Chilopoda in 1842. These most fully verified my formerly expressed belief. The *Iulidæ* and *Lithobii* were both found to possess the power of reproducing their antennæ and legs. This was proved to be most extensively possessed by the very young animal, in which the legs can be reproduced even a second time. The first of these experiments in 1841 were witnessed by my friend Mr. Waterhouse, and this gentleman bore testimony to the facts at a meeting of the Entomological Society in January 1844 when I announced them‡, on the occasion of the reading of some observations by Mr. Fortnum on the reproduction of a limb, observed by himself in *Phasma*. On that occasion I also pointed out the fact, that the armature of spines, &c. on reproduced limbs is almost always imperfect, and often

* Manual of Entomology by Shuckard, 1836, p. 427.
† Elements of Physiology by Baly, vol. i. p. 405, 1837.
‡ Ann. and Mag. Nat. Hist. vol. xvi. p. 274.

entirely absent; a fact which Mr. J. Obadiah Westwood afterwards* quietly re-announced without due acknowledgement. Mr. Waterhouse's testimony in support of my facts has also been most strangely omitted by Mr. J. O. Westwood, the Secretary, in his printed report of that meeting†, notwithstanding that Mr. Waterhouse's confirmation was duly entered in the Minute Book of the Society. Mr. Westwood however still doubted that the fact was common to the whole class of insects.

Mr. Fortnum's observations on *Phasma* confirmatory of the statement by Müller, together with Heineke's on the antennæ of *Blatta* and *Reduvius*, and an observation then made by Mr. Marshall, that he had once observed a specimen of the common *Blatta* with one leg much smaller than the rest, were regarded by Mr. J. O. Westwood as showing only a power of reproduction in those insects which do not undergo a complete metamorphosis; and on a subsequent occasion‡ he endeavoured to draw a distinction between these, and those which do undergo such change, and announced his belief that the Lepidoptera are incapable of reproducing lost parts.

With a view to set this question at rest, as I had already set at rest that respecting the Myriapoda, I made a series of experiments in the following summer on the larvæ of two of our commonest Lepidoptera, *Vanessa urticæ* and *V. Iö*, the nettle and peacock butterflies. The results of these were perfectly confirmatory of the general view, and established the fact, that a power of reproduction of lost parts is common to the whole of the Insecta. The observations on *V. urticæ* were communicated to the Royal Society on the 20th June 1844, and are printed in the 'Transactions' for that year. An account of these experiments was also given a few months later, and the specimens exhibited to the Entomological Society in October 1844, at which time Mr. H. D. S. Goodsir also gave an account of his own experiments on the Crustacea.

Thus then these experiments have established the fact as a law, that the whole of the Articulata have the power of reproducing lost parts. Every new observation on the growth of parts confirms this view. Very recently I have received, in a collection of insects from Melbourn, Port Philip, a specimen of *Panesthia*, one of the *Blattidæ*, in which the metathoracic leg on the left side has been reproduced. The entire limb is not more than one-third of that of the corresponding one on the opposite side, but, as in the insects experimented on, it possesses the whole of the essential parts of the organ—the coxa,

* Ann. and Mag. Nat. Hist. vol. xvi. p. 277. † *Loc. cit.* 274.

‡ Proceedings Ent. Soc. March 1844; Ann. and Mag. Nat. Hist. vol. xvi. p. 277.

femur, tibia, tarsus and claw, as well as rudiments of spines (Pl. VIII. fig. 2). It thus agrees precisely with the new limbs produced in Lepidoptera. I have found in every instance in my experiments that all the primary or essential parts of a limb exist when the new organ first makes its appearance; but that its secondary parts, as, for instance, the armature of spines and the joints of the tarsus, are later in their formation. The joints of the tarsus usually are fewer in number in new limbs that have not attained the normal size than in the original limbs. This is invariably the case when the limb is first produced. As the entire organ continues to grow, the tarsus becomes more and more elongated, proportionately to the other parts; and when the insect next changes its tegument, the number of joints to this part of the limb is increased by the production of a new joint at the distal extremity of the penultimate one, interposed between it and the joint which bears the claw; precisely as new segments are added to the body of the Myriapod, between the last newly-produced segment and the caudal, or penultimate, at each change of its covering. It is in this way also that new joints are developed in the antennæ of *Lithobius*, always at the distal margin of a pre-existing joint, only that in this case the new part is formed at the distal end of each previous joint.

In the specimen of *Panesthia* above alluded to, there are only three joints to the tarsus, instead of five, besides the unguis. Of these, the basilar or true tarsal joint, as in the perfect limb, is the longest, so that those joints which are nearest to the body are always, at first, most quickly enlarged and elongated. Thus, as the growth of the whole limb proceeds, first the femur and next the tibia become proportionately elongated, and lastly the tarsus and its subdivision into joints. This is a fact of some importance in a comparative anatomical and zoological point of view, because it shows that an increased number of tarsal joints amongst true insects is not a proof of inferior development.

The immediate source of origin of the new limb is extremely difficult to ascertain. My own experiments on Lepidoptera, and Mr. Goodsir's on the Crustacea, lead to the belief that the new limb has its origin in a little, elevated, central point, beneath the cicatrix which covers the surface of the space to which the old limb was attached; and that within this little elevated point, as within a capsule, the microscopic rudiments of the new limb are formed. Mr. Goodsir's observations on the Crustacea seem to show that even at this early period the limb is formed of distinct articulations; but recent observations made by myself on the original formation of the limbs in the *Chilopoda* and in the *Forficulidæ* have led me to believe that this is not the case in the earliest state of the limbs in the Myriapoda and in these insects,

but that commencing as little tubercles they are first elongated to some extent, and that their division into joints takes place at a subsequent period.

No reproduction of limbs is manifest until the period of change of tegument. Nor does the growth of a newly-formed limb continue apparent after the first few hours or day subsequent to a deciduation of tegument, when the new covering has become consolidated. The further enlargement of parts is then arrested until the next change. If a limb is lost by the young insect early in life, the newly-produced one grows more rapidly at each change, and ultimately acquires the same size and same number of joints as the normal limb on the opposite side of the body. If, on the contrary, the insect has approached to within one or two changes of its perfect state, then the new part never attains to the adult size or number of joints.

There are many circumstances which greatly influence the production of new parts. The chief of these are—the temperature and hygrometric state of the atmosphere, and the health, and quantity of nourishment supplied to the animal. If the temperature of the season is below the average height, or the atmosphere be loaded with an excess of moisture; or the insect weak and unhealthy, or not supplied with a proper quantity of food, the experiment, usually, will fail. Under the first of these circumstances the insect often dies from exhaustion from loss of blood, owing to the coagulation of effused blood not taking place; in the latter they have not sufficient power to undergo the change. Healthy insects, in a proper temperature of the atmosphere, usually begin to take food in large quantities soon after the hæmorrhage consequent on the excision of the old limb has ceased. A greater quantity of nourishment seems always to be required in the reparation of every severe injury or lesion of structure; as every severe injury always more or less retards, although it does not necessarily prevent, the usual changes. These circumstances are operative to a greater or less extent in different species of insects. Thus some species undergo their changes at a much lower average temperature than others. The common nettle butterfly, on which my first experiments were performed, undergoes its changes at a lower temperature than the peacock, *V. Iö*, the subject of my second set of observations. *Vanessa urticæ* is in general from thirteen to fourteen days in the pupa state, at a mean highest range of temperature of from 55° F. to 60° F; but the same insect undergoes its changes in from eight days and a half to nine or ten days in a temperature of from 70° F. to 75° F. The peacock butterfly, *Vanessa Iö*, requires naturally a higher temperature for its development than *V. urticæ*; it comes forth, as is well known, later in the season and nearer midsummer. It usually is fully

fourteen days in chrysalis at the seasonal temperature. The specimens bred by myself were developed in somewhat more than ten days, when the mean of the lowest temperature during that period was 71°·06 F. and the highest 75°·5 F.

In conformity with this, I found that *V. urticæ* is the best species for experiment, owing to its not requiring so high a temperature for development. On Plate VIII. fig. 3 is represented one of the specimens of *V. Iö* which were the subjects of experiment. It has the left mesothoracic leg reproduced precisely in the same stage of development as the new limb in *Panesthia*.

EXPLANATION OF PLATE VIII.

Fig. 2. Inferior surface of *Panesthia* ——? (magnified two diameters) with the left posterior leg reproduced.

Fig. 3. Inferior surface of specimen of *Vanessa Iö*, from which the left mesothoracic leg was removed at the end of the fourth change of the larva.

XVII.—*Notes on* Buccinum undatum. By Albany Hancock, Esq.

During a short residence at Cullercoats in 1841, I paid some attention to the various forms of *Buccinum undatum*, with the view to determine whether the several reputed species of this protean shell should retain the rank to which they have been elevated by some naturalists, or be reduced to mere synonyms.

In furtherance of this object I collected extensive suites of the different varieties, and soon ascertained that there are three well-marked forms, which on this coast at least do not appear to run into each other, and which are procured from distinct localities and from different depths of water. These three forms are distinguished from each other by their general shape and habit, and not merely by the undulations and striæ, characters of little importance in this portion of the genus, and on which conchologists have placed too much reliance. In all the three varieties the undulations and striæ are very variable; the form of the mouth and columella, however, is constant throughout, never losing the essential characteristics, which are retained in the most robust and coarsely undulated as well as in the most delicate and smooth.

At first I was inclined to think it probable that these three varieties might prove to be distinct species; but after a lengthened and careful investigation I feel satisfied that they are mere varieties, though of permanent and strongly-marked characters, resulting from locality and depth of water. The animals of these three varieties do not appear to vary.

It is evident from what has been said respecting the undula-

tions and striæ, that the surface of the shell in this species cannot be depended on, whether these three varieties are to be considered specifically distinct or not; but that failing the animal we must look to the columella and mouth, and of course to the general form and habit, for specific characters. Keeping this in view, I have drawn together the following notes, which I trust may assist in elucidating this intricate species.

I find by a recent number of the 'Annals,' that Mr. Wm. King has described these three varieties, giving an account of their localities and general habits as I pointed them out to him, shortly after I had commenced the examination of the species. I was rather surprised at this, particularly in respect of the coarse variety without an epidermis, and the shore variety, as I believe he had never collected these two forms himself, nor has he ever possessed a sufficient number of them to illustrate their peculiar modifications and the permanency of their characters, and as he was aware that I was about to publish on the subject. He however commits an error, when he states that the shore variety is only found on rocks and pebbly bottoms. Had he attained an accurate knowledge of the subject, such as might be derived from personal experience on the coast of Northumberland, he must have known that it also occurs on mud.

It has been stated by Mr. Gray, that "the thickness, the roughness, and the smoothness of the surface of shells appear to depend, in a great measure, on the stillness or agitated state of the water which they inhabit. The species of our own coast," that gentleman says, "afford abundant instances of this: the shells of *Buccinum undatum* and *B. striatum* of Pennant have no other difference, than that the one has been formed in rough water, and is consequently thick, solid and heavy; and the other in still water of harbours, where it becomes light, smooth, and often coloured."

This is scarcely corroborated by what is observed on the Northumberland coast: there, the thickest and roughest forms are from twenty fathoms water, and the thinnest and smoothest from much greater depths. In both these cases the water is probably less agitated than in harbours, where the depth is generally much less. The third variety, however, which is intermediate in coarseness and thickness, is procured between tide-marks, and consequently subjected to the most violent action of the sea. The thin delicate specimens are, I believe, always found on a soft sandy or muddy bottom, and the strong rough individuals on hard or rocky ground. It is therefore probable that the food, varying in localities so different, may modify development. The three principal varieties themselves undergo considerable change on different grounds, irrespective of depth. Thus the beach variety on rocks

is strong, rather rough and without an epidermis, but on mud it is clothed with a thick hairy epidermis, and is comparatively smooth and thin. No doubt many causes are in operation to produce these changes, and the stillness or the agitation of the water may have some influence; but the nature of the ground and depth would appear to be the chief agents in modifying the forms of this species.

The mouth of *B. undatum* is oval, and the arch of the columella is not much interrupted at its junction with the outer lip by the bulging of the body whorl into the mouth; near the middle there is an obscure fold or swelling which gives to the columella the appearance of being twice bent, and before sloping off to the left it is advanced towards the outer lip: the enamel does not extend far over the body whorl.

Slight variations of course occur; in some the mouth is wider and more rounded than in others, and the columella varies a little in length: as a general rule it is shortest in the thin and delicate varieties, but to this there are many exceptions.

All the various forms of *B. undatum* concur in these characters of the columella and mouth, and may be placed with one or other of the three principal varieties found on the coast of Northumberland, which I shall now proceed to describe.

Variety 1. is found in forty fathoms water and upwards on a muddy bottom.

Mr. Alder informs me that on the west coast of Scotland it occurs in much shallower water.

This variety is undoubtedly the true *B. undatum*, and is taken everywhere on the British shores: it is sometimes four or five inches long; the shell is moderately thick with the undulations well-developed, and is always covered with a somewhat strong hairy epidermis; the spire is usually as long as the mouth, and the whorls are considerably rounded. In this state it is the *B. vulgare* of Da Costa, and the *B. undatum* of Müller, Bruguière, Montagu, Donovan, Kiener, Brown and others. The *B. anglicanum* of Brown and the *B. striatum* of Pennant also belong to this state, varying only by having the undulations more or less obliterated, and the spiral striæ well-marked and regular. The *B. anglicanum* of Lamarck is not a British species.

This variety is occasionally very thin and delicate, and has the spire sometimes considerably produced and the whorls much rounded. The *B. undatum* of Brown (Illust. Conch. 2nd. ed. pl. 3. fig. 2) is an example of the extreme form of this state which occurs not unfrequently on the Dogger-bank. It is however impossible to draw any line of demarcation between these thin, delicate, elongated shells and the more general appearance of this variety.

Fleming unites *B. Humphreysianum* with his *B. striatum*. I

have seen nothing, however, to warrant the union of that species with any of the varieties of *B. undatum*, and am inclined to consider the former well characterized; it is distinguished from the latter by the ovate form of the mouth and the shape of the columella, as well as by the character of the surface.

The *B. carinatum* of Turton is a mere lusus of the deep-water variety (var. 1.). There is in the Newcastle Museum a specimen taken by the Rev. J. Law on the Durham coast like Turton's shell with the whorls flattened and carinated above, without undulations, and rather finely and regularly striated. The form of the columella and mouth of this specimen also agrees with the figure of *B. carinatum*, and proves it to be *B. undatum*, whilst the epidermis and general form of the shell place it with this variety.

Varieties like *B. carinatum* occur in various species, and are occasioned by some original malformation of the mantle, or by injuries sustained by it. These varieties therefore frequently exhibit old fractures of the shell. I possess a specimen of *Littorina vulgaris* which has the whorls strongly flattened and carinated above. The shell however was originally of the normal form; but a fracture is apparent in the second or third whorl, and from thence the abnormal appearance is continued throughout the succeeding whorls. Had the fracture been unattended by injury to the mantle, the shell would have assumed its proper shape, as is commonly seen to be the case in repaired shells.

Variety 2. is procured in twenty fathoms water on a hard gravelly bottom.

It is common on the Northumberland and Durham coasts, where it is brought to shore by the fishing-boats. This variety is smaller than variety 1, rarely measuring more than three inches long; it is somewhat fusiform, very thick, heavy and rugged, and generally much undulated; the spire, which is as long as the mouth, is conical, and the whorls are not much rounded; the mouth is white, or occasionally of a yellowish colour: this form has no epidermis.

The *B. undatum* of Pennant perhaps belongs to this variety, judging from the figure, in which the outer lip appears to be in a growing state. An elongated form of it is figured in Brown's 'Illustrations of Conchology,' 2nd ed. pl. 3. fig. 1. In Mr. Alder's cabinet there is a specimen from Zetland precisely agreeing with this figure, which is stated to be from an individual procured from deep water off the Orkney coast. The *B. Zetlandicum* of Forbes also appears to belong to this variety, differing from Mr. Alder's shell and Captain Brown's figure only in being devoid of undulations, and more regularly and finely striated; the spire, too, is not quite so much produced. A specimen closely resembling the *B. Zetlandicum* was taken on the Durham coast

by the Rev. George Cooper Abbs: it is almost without undulations, and is finely and regularly striated. There can be little doubt that this individual is a mere modification of variety 2.

The *B. Zetlandicum* seems to be different from *B. fusiforme* of Broderip, with which Professor Edw. Forbes, however, is disposed to unite it. It is probable that *B. fusiforme* occurs in the seas around Zetland, for I have seen a drawing of a shell brought from thence by Dr. Charlton which agrees very accurately with Broderip's figure, particularly in the form of the columella and mouth, the peculiarities of which would appear to distinguish this species from all its allies.

In the Newcastle Museum there is a very much elongated shell with the whorls flattened and the apex much acuminated. This specimen was taken on the Durham coast by the Rev. J. Law, and is undoubtedly a mere lusus belonging to variety 2: it is only an inch and a half long, and is imperfectly and obscurely undulated. In other respects it is a very good representation of *B. acuminatum* of Broderip; it lacks however somewhat of the perfect symmetry of that shell, but has the strong plait and general form of the columella, thus proving it to be a slight modification of Broderip's shell, which however most probably belongs to variety 1, as it is described to have an epidermis.

After a careful examination of the specimen in the Newcastle Museum, it seems to me impossible to insist on the specific distinctness of *B. acuminatum*; and it is satisfactory to observe that Mr. Gray considers the specimen of that reputed species in the British Musum to be merely a variety of *B. undatum*. The flattened whorls and the shape of the spire are evidently of no importance as specific characters; and the form of the mouth and columella does not distinguish it from *B. undatum*. It is true the characters of these parts are considerably exaggerated, but certainly not more so than might be expected in a lusus, whose deviation from the normal form is mainly dependent on the extraordinary growth of the pillar.

Variety 3. occurs between tide-marks on rocks and mud.

This variety is not uncommon on the coasts of Northumberland and Durham; I have received it also from the east coast of Scotland and the west coast of England, and Mr. Alder has taken it in the Isles of Bute and Arran. It may always be distinguished from the two preceding varieties by its short, conical spire and large body whorl; the mouth is longer than the spire, and the undulations are never very strong, and are sometimes quite obliterated; the whorls are somewhat flattened; the epidermis, which is frequently wanting, is occasionally strong and hairy; and the shell is generally of a uniform darkish brown colour, occasionally of a yellowish hue, sometimes white; I have never seen it with co-

loured bands as in the preceding varieties, though, from imperfect indications of them in one or two instances, it is not improbable that this variety may occasionally assume the markings of the deep-water shells*; the mouth is rarely white, most frequently of a deep rich purple-brown, occasionally tawny or of a fine bright yellow, particularly when the shell is white or pale.

A very interesting modification of this variety occurs on the Lancaster Sands, where it was procured in abundance by Mr. Charles M. Adamson. The undulations of this form are scarcely to be distinguished, and in many individuals are completely obliterated; the striæ are generally very strong and regular, with finer striæ between them, giving the surface precisely the appearance of *B. striatum* of Pennant; the surface is however occasionally devoid of the more elevated striæ, and is closely covered with fine but somewhat irregular striæ. Another striking modification of this variety was taken by the Rev. J. Law on rocks near Sunderland: it is white with a bright yellow mouth, having the surface well undulated and the striæ strong and much elevated.

Dr. Johnston mentions in the 'Proceedings of the Berwickshire Naturalists' Club,' a shell with a purple mouth that occurs in Berwick Bay, which probably belongs to this variety; and the *B. undatum* of Gould's 'Invertebrata of Massachusetts' appears also to resemble it. The golden-coloured mouth of the American shell, and its locality, which is stated to be "on the rocky bars in Boston harbour," go far to prove that it belongs to this form. Professor Edw. Forbes also mentions in his 'Malacologia Monensis' a dwarf form of this variety as occurring near Bergen in Norway, and in the Firth of Forth. With these three exceptions, this strongly-marked variety appears to have escaped the notice of writers on the subject.

Newcastle-on-Tyne, January 26, 1847.

XVIII.—*On a second form of Fructification in* Peyssonnelia Squamaria. By C. Montagne, D.M., *in a Letter to the* Rev. M. J. Berkeley, M.A., F.L.S.

I told you in my last letter of a new form of fructification which I had just discovered in a specimen of *Peyssonnelia Squamaria* from Algiers. I propose at present to trace the history of this discovery, to describe these new organs, and to subjoin some brief notes on Nemathecia.

In studying the Fungi collected by Drège at the Cape which had been placed in my hands by Professor Miquel of Amsterdam, I found under the number 4108 (44) a specimen of *Peyssonnelia*

* Since writing the above, Mr. Richard Howse has informed me that he has recently taken this variety with coloured bands.

which presented some peculiarities of structure. The frond, in other respects resembling that of young individuals from the Mediterranean, presented on its upper surface a multitude of granules of a paler tint, which gave to it the appearance of a man's skin affected with a miliary eruption. A thin vertical slice of the frond placed under the microscope showed the central and horizontal layer of quadrilateral cells from whence were given off on one side the root-like threads which form a sort of nap on the lower surface, and on the other the filaments, which at first ascending and oblique, become vertical and terminate on the outer surface which is formed by the intimate adherence of the ultimate articulations. In the Cape plant the four or five articulations nearest to the surface turn up and form with the others an angle of about 130°, which circumstance presents a certain analogy with what takes place in the cylindric fronds of certain *Florideæ* of the tribe *Cryptonemeæ*; analogy, I say, for there is no real resemblance.

It is amongst the ascending filaments, and not those which have resumed their original vertical direction, that I have observed the agglomerations of granules which may be considered as spores. It is these little elevations which give to the frond the appearance of which I have spoken above. They are about the tenth of a millimetre in diameter, and are composed of free oblong granules $\frac{3}{100}$ths of a millimetre long, and rather thicker than $\frac{1}{100}$th of a millimetre, entire, or divided into two transversely; some appeared to be divided crosswise into four, like true tetraspores, but I cannot affirm this positively. Their more intense colour and greater opakeness prevent their being confounded with the endochromes from which they probably derive their origin, though it is difficult to say how. Supposing then that they are organs destined to multiply the species, it is impossible not to see that they differ from the normal tetraspores of the *Peyssonnelia* of our coasts, by their aggregation, their form, their proportionally smaller size, and above all by their position.

Desiring to re-examine the already well-known fructification, and of which Decaisne, Kützing and Zanardini have given good figures, not to mention the more recent analysis of *P. Dubyi* by Mr. Harvey, I placed under the microscope a very thin vertical slice taken from the centre of a nemathecium of a specimen sent from Algiers by Dr. Guyon. What was my astonishment, when instead of seeing what I had so often observed, and indeed had just described for the 'Flora of Algiers,' I perceived an entirely different form of fructification!

The pustules formed by the nemathecia have just the same dimensions as those of individuals bearing tetraspores. They are composed of two sets of filaments, the one extremely delicate,

apparently dichotomous, but in reality simple, with long endochromes, performing probably the office of paraphyses; the others of the same length, but far larger; and it is remarkable that it is the endochromes of these which become spores absolutely in the same way as in a great number of conceptacula of *Florideæ*, as for instance in *Nothogenia variolosa, Melanthalia Jaubertiana, Plocaria confervoides, Sphærococcus coronopifolius, Delesseria hypoglosson*, &c. (see the analyses given by myself and Kützing). Thus we find rows of two, four, six or even eight spores, according to the degree of evolution at which the nemathecia have arrived. It appears that their development proceeds from the upper part of the thread, taking a downward course, because those which are nearest the upper surface of the nemathecia are the largest and most spherical, the lower ones being still elongated and clavæform, and much more slender. This however may depend on the form of the nemathecia whose convexity allows a greater extension than the base. The number of the spore-producing threads is large enough to make one imagine that the nemathecia are entirely composed of them, but in compressing them under Shiek's compressorium, threads are distinctly observed remaining still in the form of paraphyses. When the row consists of four spores only, it might be taken for a linear tetraspore. Nevertheless there is even then this difference, that in this case the extreme spores are neither similar nor equal to one another. The upper one is $\frac{3}{100}$ths of a millimetre in length, and rather more than $\frac{2}{100}$ths in breadth, rounded above and truncate below; the second and third are truncate at either end. The form of the lower was described before; its length is $\frac{4}{100}$ths of a millimetre, and its greatest thickness $\frac{2}{100}$ths. Observe, I am describing here only a single series of spores, for they are very variable according to the number of the spores of which they consist. I should add, that when they are once free they are soon clothed with a distinct perisporium and acquire larger dimensions. Hence I have measured some, which, together with their perispore, had a diameter of $\frac{1}{20}$th of a millimetre.

On the whole then, this form of fructification appears to me to correspond with that which one meets with in the conceptacula of *Sphærococcoideæ* and *Delesseriæ*. It differs simply in the absence of a conceptaculum properly so called, which is here replaced by filaments radiating from the surface which give rise to the nemathecia.

Nemathecia then may inclose three forms of fructification: 1. masses of spores inclosed in a pericarp (*Favellidia*, J. Ag.) as in *Polyides*, and perhaps in *Rhizophyllis* (see Fl. Alg. t. 16. fig. *c* and *d*); 2. tetraspores which may, as we see in the genus *Fauchea* (*l. c.* t. 16. fig. 1 *h*), and in *Peyssonnelia*, grow between the radia-

ting filaments, or, as in *Chondrus*, *Gymnogongrus* and *Phyllophora Stiridia* (*l. c.* t. 16. fig. 5 *d* and 5 *e*), derive their origin from the metamorphosis of the endochromes of these filaments; 3. a form of fructification which may possibly be merely a modification of the former, in which the endochrome, suffering a normal hypertrophy, is not divided as a tetraspore, and presents an analogy to what one meets with in certain conceptacula. However this may be, one must allow that the organs in question are true spores, since they are exactly like those of the species with which I have compared them as regards their mode of reproduction. I ought to add, that Mr. Harvey has seen something like this in the nemathecia of *Phyllophora Brodiæi*, but he does not say whether it is in the same nemathecium which incloses the tetraspores, which would make a great difference.

XIX.—*Note on the genus* Atya *of Leach, with descriptions of four apparently new Species, in the Cabinets of the British Museum.* By G. Newport, F.R.S. &c.

[With a Plate.]

Fam. Macroura, *Latr.*, *Leach.*

Gen. *Atya*, Leach.

When Dr. Leach described this genus of Macrourous Crustaceans, he was acquainted with only one species. There are four specimens of this in the cabinets of the British Museum, but nothing whatever is known of their habits, or from whence they were obtained. M. Milne Edwards, in his work on Crustacea, states that *Atya scabra* is from the coasts of Mexico. A species described in Wiegmann's 'Archives' for 1836, *Atya mexicana*, is from the same country. Whether this is identical with Dr. Leach's species is not ascertained. Two new species have since been added to the collection in the British Museum, one from Jamaica and the other from the Philippine Islands. I have myself received two others, presented to me by my friend Dr. M'William, R.N., the indefatigable officer of the Niger Expedition, to whose kindness I am also indebted for other valuable specimens of natural history. These Atyas are now in our national collection. One of them, a small species, is from New Zealand. This is a female with an abundance of ova attached, and near the period of hatching: it was found in brackish water at Apia, Upolu, nine miles inland. The other species is of the size of Dr. Leach's *A. scabra* and very closely resembles it, so that it may prove to be only a variety of it; but it seems to differ from Dr. Leach's species in having the legs slightly sulcated, and the middle plate

of the tail has a deep triangular sulcus, and the antennæ are not more than one-half the length of the body. It was captured by Dr. M'William in fresh water, 300 feet above the level of the sea, at San Nicolao, Cape Verd Islands. This fact, and that of the New Zealand species inhabiting brackish water, seem to show a natural affinity in habits as well as in structure with the genus *Astacus*, as well as with *Crangon*; the latter being a truly marine genus, while the former includes both freshwater and marine species.

Genus Atya, *Leach.*

1. *A. scabra*, Leach, Linn. Trans. vol. xi. p. 345; Zool. Misc. iii. p. 29. Feb. 1831.

2. *A. mexicana*, Wiegm. Archiv, 1836, 145.

3. *A. sulcatipes*? Newport. Pl. VIII. fig. 1.

Body compressed, deep; thorax slightly pubescent, with the rostrum short, trifid; third pair of legs very strong, and, together with the fourth and fifth, covered with obtuse elongated tubercles, armed with short stiff hairs; the femoral joints rounded, subclavate, with an oblique sulcus on the anterior lateral surface of each extended to the front of the tarsal joint; middle plate of the tail with a deep triangular sulcus. Length in recent state 3 inches.

Hab. in fresh water, San Nicolao, Cape Verd Islands. In the collection at the British Museum.

4. *A. occidentalis*, Newp.

Thorax, abdomen and first two pairs of feet smooth; rostrum conical, with its sides subangulated; third pair of legs the largest, but somewhat slender, and with the fourth and fifth pair covered with smooth obsolete tubercles without hairs, tarsal tubercles slightly elongated. Length $1\frac{3}{4}$ inch.

Hab. West India Islands.

There are four specimens of this distinct species in the British Museum; they were taken by Mr. Gosse in Jamaica. The species seems to be common to the West India Islands, and appears to be that which is figured and described, but not named, by Gronovius, tab. 17. fig. 6. p. 231. No. 988 of 'Zoolophylacii Gronoviani,' fasc. secund. Lugd. Batav. fol. 1764, in which it is said—"Habitat in Oceano Americano ad Martinicam."

5. *A. spinipes*, Newp.

Thorax and body smooth; rostrum conical, simple, with an acute median ridge; third pair of legs with the femoral joints almost smooth, slightly elongated, with an oblique furrow on the anterior external surface, and armed in front with a long acute spine, and with a second smaller one more posteriorly; tibial and

tarsal joints equal in length with minute tufts of hairs. Length $1\frac{3}{4}$ inch.

Hab. Philippine Islands. One specimen in the British Museum, from the collection of Mr. Cuming.

6. *Atya pilipes*, Newp.

Body smooth; rostrum simple, triangular, very short, with a slight median ridge; fourth and fifth pairs of legs nearly equal; femoral joint with an oblique sulcus on the external surface, fringed with a margin of dense fine hairs. Length $1\frac{1}{2}$ inch.

Hab. Apia, Upoln, New Zealand. One specimen in the British Museum cabinet. I have been unable to derive characters for this species from the third pair of legs, both these being absent.

XX.—*Notes on a Dredging Excursion off the coast of Durham; with descriptions of the Ova-Capsules of* Fusus Norvegicus *and* F. Turtoni. By Mr. Richard Howse.

[With a Plate.]

On the 29th of last June I sailed from Staithes, a fishing hamlet on the Yorkshire coast, in one of the fishing luggers which during the summer months visit the inner or western edge of the Dogger-bank. I made this marine excursion for the purpose of examining the Invertebrata of that much-frequented fishing-ground, and therefore went prepared with a dredge and the other necessary apparatus for collecting.

Unfortunately the weather was most unfavourable, the wind blowing a gale from the west. We were driven about from Monday, the day on which we sailed, till Wednesday morning without being able to use the dredge; during the latter day, however, we had three hauls with it, but had no other opportunity of putting it down. The wind freshening towards evening we were obliged to leave off dredging, and on the following morning steered for the shore, which we reached in the afternoon.

The little dredging we had was in sixty fathoms water, on a fine, gray, sandy bottom, about fifty miles east of the coast of Durham, and about the same distance from the western edge of the Bank. The result, though small, was more satisfactory than under such unfavourable circumstances I had any reason to expect.

The following mollusks were taken: a few specimens each of *Fusus antiquus* and *F. Islandicus*; a beautiful specimen nearly an inch in length of *Fusus Barvicensis*; one of *F.? lineatus*; speci-

mens of *Buccinum undatum, Natica Grœnlandica, N. Montagui*; several of *Turritella terebra*; one of *Tornatella fasciata*; several of *Dentalium entale*; specimens of *Venus ovata, Venus laminosa* and *Psammobia Ferroensis*; *Astarte Damnoniensis* in great abundance—as many as would fill a quart measure were obtained; a few fine specimens of *Astarte Scotica* and *A. compressa*; two of *Kellia suborbicularis*; dozens of *Montacuta substriata* adhering to the spines of *Spatangus purpureus*; one of *Solen pellucidus*; a few of *Cardium echinatum*; two specimens of *Pecten opercularis*, and several valves of *P. obsoleta*. These were all living with the exception of *Natica Grœnlandica, N. Montagui, Psammobia Ferroensis, Venus ovata, Cardium echinatum* and *Pecten obsoletus*.

From the quantity dredged, the bottom must have been thickly strown with *Spatangus purpureus*—nearly half a peck were brought up the second haul; and when the dredge was taken on board the third and last time, it was pressed almost full of this species, which hitherto has been considered rare on the coast of Durham and Northumberland. Six specimens of another species of *Spatangidæ* were also procured at the same time. These most nearly resemble *Bryssus lyrifer*, but are much larger and less compressed than that species. The dorsal lyriform impression is almost obsolete, and it will probably prove distinct from any recorded British species. Very few starfish were dredged; only two or three specimens each of *Ophiura texturata, Ophiocoma rosula, Asterias aurantiaca* and *Uraster rubens* were brought up.

As might be expected from the sandy nature of the sea-bottom, the dredging was rather unproductive in zoophytes; only a few were obtained; a beautiful living specimen of *Retepora Beaniana*, and a few dead ones of *Celiepora Skenei* and *C. ramulosa*.

Four specimens of a new and interesting variety of *Fusus Islandicus* were also taken. In general outline this variety is short and tumid, the spire having the appearance of being pushed in. The lower part of the body-whorl is much puffed out, the upper part flattened and folded over at the suture. The canal is very much curved, and more inclined to the left than usual. The chief character, however, is in the epidermis, which is hispid; the hispidations are very fine, and occur at the crossing of the striæ of growth with the spiral striæ. The largest specimen is about 1¼ inch in length and ½ inch in width, and has seven whorls. Plate X. fig. 5. will give a pretty correct idea of this variety, which from the number obtained, the constancy of form and other characters, must be regarded as permanent.

The most interesting objects, however, that I procured were two ova-capsules of *Fusus Norvegicus*, which I shall describe further on. In this place I very much regret having to state that Mr. Wm. King, Curator of the Newcastle-on-Tyne museum,

has put the result of this dredging excursion in a note on *Retepora Beaniana* (p. 238), and that he has also given notice of the ova-capsules of *F. Norvegicus* in the text of his paper in the 'Annals' of October last. This is the more to be deplored, as his description is partly erroneous and very imperfect. I allowed this gentleman to examine the capsules, but did not for a moment suppose that he would publish an account of them without my consent or knowledge.

In addition to those objects resulting from the dredging excursion, I have obtained several interesting specimens from the coasts of Durham and Northumberland from other sources. From the Haddocks, those indefatigable collectors, I have procured one specimen each of *Neæra cuspidata* and *Bulla Cranchii*, and two of *Natica helicöidea*; this is the first time, I believe, that this rare shell has been taken so far south. From the fishermen, less careful and less industrious collectors than the former, I have received fine specimens of *Fusus Turtoni*, *F. Norvegicus*, *F. Barvicensis*, *Trochus millegranus*, the two last fished up off Berwick; two or three specimens of *Natica Grœnlandica* and *Scalaria Trevillyana*; a large single specimen of *Panopæa arctica*, and a single specimen each of *Retepora Beaniana* and *Bryssus lyrifer*. This is the first time the last-mentioned species has been recorded as being taken on the coast of Durham. It is most probably not uncommon, as Mr. A. Hancock informs me that he has procured it from the fishing-boats at Cullercoats.

I have also obtained from the fishermen three ova-capsules of *Fusus Turtoni*. These capsules are exceedingly interesting, as they, together with the capsules of *F. Norvegicus*, prove very clearly the distinctness of these two rare and little-known species, which by some conchologists, I believe, have been considered as mere varieties of *F. antiquus*.

Ova-capsules of Fusus Norvegicus. Plate X. fig. 3.

The spawn of *F. Norvegicus* was dredged July 1, 1846, in sixty fathoms water as before stated. Only two were taken; they are of a subhemispherical form, about one inch in diameter, and are agglutinated separately by a very thin, produced marginal rim to the inside of old valves of *Cardium echinatum*. The envelope is coriaceous, of a horny appearance, very transparent, smooth, glossy and of a yellowish colour; one of the capsules contained three, the other only two embryos. The last were far advanced, and apparently ready to leave the case. Through the transparent covering when first dredged, I could see them moving about and adhering to the inner surface of the capsule by the expanded foot, the sides of which were of a faint lilac colour. The thin oper-

culum, the flattened tentacles, the diminutive spot-like eyes of these beautiful and interesting creatures were also distinctly visible. The young shell is very thin, brittle, pellucid, brilliantly glossy and of a pale amber colour, nipple-formed, and perfectly resembles the nucleus or upper whorl of the adult individual, as will be seen by referring to the accompanying plate. Those most advanced in growth have two whorls, and are half an inch in length by a quarter in width.

There is an interesting circumstance connected with one of the capsules which may give some idea of the time required to mature the embryo of this animal. A *Serpula* overlies a considerable portion of the flattened marginal rim, and must therefore at least have grown the length it has attained from its first attachment to the rim, about an inch, since the capsule was deposited. The embryo therefore requires more time for its development than a *Serpula* does to increase an inch in length.

Ova-capsules of Fusus Turtoni. Plate X. fig. 9.

The ova-capsules of *F. Turtoni* were fished up off the Northumberland coast last June. Three were obtained; two were attached to the inside of a valve of *Modiola vulgaris*, and one to the outside of another valve of the same species. They differ completely from those of *F. Norvegicus*, in shape, in being double, in number of embryos, and in mode of attachment; but agree with them in being solitary. They are ovate, compressed, lentiform, and are supported on a short flattened peduncle. This peduncle is a production of part of the margin of the capsule, and is considerably spread at its base over the surface to which it is attached. The capsule is composed of an inner and an outer case; the latter is of a pale yellow colour, opake, not very glossy, coriaceous, and has a few raised lines across the upper surface; the former is very thin, and separated from the latter by a parallel, fibrous, silky layer. One of the capsules is nearly an inch in greatest diameter, and contains six embryos, the largest of which is half an inch in length by one-fifth in width, and has three volutions which perfectly resemble the apex of the mature individual. They are almost cylindrical, coarse, opake, the last whorl faintly spirally striated and of a reddish brown colour.

From the above descriptions it is evident that these two forms are specifically distinct from each other, and from those with which they have been and are most likely to be confounded, viz. *F. antiquus* and *B. undatum*. The spawn of *F. Norvegicus* cannot for a moment be mistaken for that of *F. antiquus*, as the capsules of the latter are only half an inch in diameter, and are very coarse and corrugated, and piled one upon the other in a conical heap.

Neither can the capsules of *F. Turtoni* be mistaken for those of *B. undatum*, which are not more than a quarter of an inch in diameter, and contain upwards of twenty-four embryos. In conclusion, it is utterly impossible for the most casual observer to mistake the spawn of these distinct and interesting species, or to confound them with one another.

The following table will show at a glance a few of the chief points of distinction :—

	Capsules.	Embryos. Size of.	Embryos. No. of, in each capsule.
Fusus Norvegicus......	1 in. diam.	$\frac{1}{2}$ by $\frac{1}{4}$ in.	2 or 3
—— *Turtoni*	$\frac{9}{10}$ by $\frac{7}{10}$	$\frac{1}{2}$ by $\frac{1}{6}$	6
—— *antiquus*	$\frac{1}{2}$	$\frac{1}{4}$	2—4
Buccinum undatum ...	$\frac{1}{4}$	$\frac{1}{12}$	24

EXPLANATION OF PLATE X.

Fig. 1. *Fusus Norvegicus.*
Fig. 2. Operculum.
Fig. 3. Ova-capsule.
Fig. 4. Embryos.
Fig. 5. *Fusus Islandicus*, hispid var.
Fig. 6. *Fusus Turtoni.*
Fig. 7. Operculum.
Fig. 8. *F. Turtoni*, young.
Fig. 9. Ova-capsule.
Fig. 10. Embryos.

XXI.—*The Birds of Calcutta, collected and described by* Carl J. Sundevall*.

[Continued from p. 95.]

82. *Parra indica*, Lath. no. 10.—P. melanochloris, *Vieill. Gal.* tab. 264 (colore superne nimis viridi. In descr. *Parræ melanoviridis*). P. superciliosa, *Horsf. Jav. Linn. Tr.* xiii. *Obs.* P. ænea, *Cuv. R. A.* e Brasilia, huic affinis an eadem ?

Supra fusco-ænea, dorso postico castaneo, alis muticis, subtus remigibusque nigris; naribus ovalibus. (Cauda brevis, gradata, vix excedit alas.)

Adulta. Atra, viridi-nitens, vitta pone oculos alba. Dorsum antice cum alis extus saturate fusco-ænea. Dorsum postice et cauda obscure rufa, violaceo-nitida. Iris fusco-rufescens. Rostrum flavum, basi cute libera, supra frontem jacente, postice semicirculari, instructum. Pedes fusco-virescentes. Longit. $10\frac{3}{4}$ poll. Ala 174 millim., tarsus 74, digitus medius 72, cum ungue 101; digitus posticus 31, cum ungue 90; rostrum e fronte 36, cauda 36. (♂ mense Febr. Alius Martio simillimus.)

* Translated from the 'Physiographiska Sällskapets Tidskrift' by H. E. Strickland, M.A.

Junior, ♀, d. 20 Febr. (an adulta ?). Gula et corpus subtus alba; latera colli vitta longitudinali pallide flavescenti, ad alas extensa. Caput supra ferrugineum, lateribus cum gula et macula brevi supra oculos albis. Collum postice nigrum, antice pallide rufescens. Dorsum et alæ paullo dilutiora quam in adulta. Dorsum postice ferrugineo-fuscescens, paullo æneo-nitens. Rectrices rufescentes, extus albidæ, linea intramarginali (concentrica) nigra. Alæ subtus pure nigræ. Iris et pedes ut adultæ. Rostrum sordide flavescens, vix ullo rudimento membranæ frontalis. Long. 10 poll. Ala 168 millim., tarsus 69, digitus medius 68, cum ungue 88; pollex 30, cum ungue 75, rostrum e fronte 34.

The genus *Parra*, which belongs to the torrid zone of both continents, is especially marked by its long toes, provided with quite straight, almost disproportionately long claws, so that the expanse of the foot is longer than the closed wing. They consequently tread upon a very large surface, and are enabled to run on the very softest mud, or occasionally on the surface of the water, which is covered with the leaves of aquatic plants. *P. indica* is not rare around Calcutta, and is often seen to run across water-tanks where *Nymphæa lotos* grows. Sometimes this bird is heard to utter a short whining cry almost like *pja-o*! In March many were seen together, running round each other; they could not be pursued in a flock, but each flew by itself when alarmed. Nothing was found in the stomach but a kind of roots or bulbs of some common water-plant. The same substance was found in the stomachs of all the herbivorous water-birds, but I omitted to ascertain whence it was procured.

83. *Parra luzoniensis*, Sonn., Lath. (certe a *P. sinensi* distincta).

Supra grisea; alis spinosis, subtus albis, remigibus arcuatis: anticis apice appendiculatis. Caudæ apice elongato, acuto, adscendenti.

Indiv. sexus incerti (veris junius) d. 23 Martii. Corpus superne fusco-griseum, parum violaceo-nitens; subtus et lateribus, jugulum et major pars alæ pure alba. Frons albo varia. Vitta e rostro supra oculos alba, dein in colli latera deflexa, flava, ad alas extensa. Vitta alia nigra, per oculos in collum descendens, priorem limitans, ante pectus cum pari conjuncta, jugulum cingens. Ala alba, extus plaga magna colorata e tectricibus griseis, fusco-undatis. Remiges cubitales omnes immaculatæ albæ; primariæ falcatæ, acutæ: 1 et 2 nigræ; 3 basi late alba; sequentes albæ, apice nigro marginatæ; 1ª—3ª appendice lanceolato, e rhachide elongata, primo nuda, dein brevius plumata. Rectrices albæ; 2 mediæ fuscæ; angustatæ, acutæ, laxæ, apice paullo sursum curvato; mediæ longæ: 2 poll. ultra alas. Rostrum fuscum, limite frontali transverso absque lobo. Pedes nigricantes. Spina carpi valida, acuta. Long. $12\frac{1}{2}$ poll. Ala 210 millim., tarsus 55, digitus medius 55, cum ungue 73; pollex 22, cum ungue 49; rostrum e fronte 27, cauda 105.

This species lived in the same manner as the foregoing, and on the same vegetables, but was more rare. It more often utters its restless cry, and during flight keeps its wings more still. It is remarkable for the appendage to the points of the wings, and has a strong, sharp point on the bend of each wing. This last character occurs in many waders of the torrid zone, *e. g.* many species of *Parra*, *Vanellus*, *Charadrius*, *Palamedea*, &c.

84. *Gallinula phœnicura*, Lath.—Rallus ph., *Gm.* Gall. erythrina, *Bechst.*, *Lath.*

Nigricans crisso ferrugineo. (Affinis *G. chloropodi.*)

♂ (junior? d. 14 Dec. e *Ceylon*; nec a me in Bengalia inventa). Cinereo-nigricans, olivacco tincta. Gula et vitta longitudinalis e rostro ad abdomen alba, sed corporis collique latera colore dorsi. Abdomen et plumæ tibiæ rufo-testacea. Crissum ferrugineum. Cauda mollis, rotundata, fusco-nigra. Alæ fusco-nigræ, remige 1ª margine externo albo. Rostrum et pedes flavi. Lamina frontalis minima seu vix ulla: tantum e culmine rostri, basi paullo dilatato; postice rotundata; colore rostri. Longit. (collo extenso) 13 poll. Ala 165 millim., cauda 70, rostrum cum laminula frontis 37, digitus medius 53, cum ungue 64; tarsus 53, os tibiæ 83, extensio alarum 20 poll.

Structura. Corpus valde compressum, angustius quam *G. chloropodis*, collo longiore in formam S inflexo. Rostrum ut *G. chlorop.* Lingua cartilagineo-carnosa, crassa, apice membranaceo-lacera. Ala inermis, rotundata. Pedes toti scutati, ut in *G. chloropode* constructi, sed ratione corporis majores. Ventriculus valde musculosus. Intestinum longit. 20 poll. pariete crassa, cavitate tenuissima. Intestina cæca 2, longit. 1 poll.; ab ano 2 pollices distantia.

This water-hen was caught on board ship about twenty [Swedish] miles west of Ceylon, in 5° 50′ N. It had consequently flown a longer way than I could have expected one of these heavy-flying birds to do when it was not the season for migration, at which time a remarkable and peculiar vigour is excited in birds. I did not see it in Bengal, but will not assert that it is not found there. In the stomach were many pebbles, and remains of plants which resembled those mentioned under the species of *Parra*. It flew with a rapid motion of the wings almost like a partridge, and with the feet stretched backwards. The readiness with which it went upon deck, and especially on the cordage, sometimes even on the rigging, was remarkable. It grasped the ropes with wonderful security by means of its long curved toes, and seemed to be accustomed to climb among reeds and branches in the marshes of Ceylon.

85. *Fulica atra*. Only one specimen of the Coot was seen; I shot it on March 24, in the small lake near Sucsagor which I have often mentioned, as it was swimming among the roscate

Lotus-flowers. It presented no difference from a full-grown Swedish specimen. The frontal disc was white, and not larger than in our own specimens; after drying it as usual became red. It had fed on the same sort of water-plants as *Parra indica*. (Length $15\frac{1}{2}$ inches; wing 210 mill.; tarsus 62; middle toe and claw 87; beak from front 31.)

86. *Scolopax gallinago*, Linn. The common Snipe is one of the more frequent birds near Calcutta, where it is considered to be in great measure stationary, but in all February and March they are found in much greater numbers than in April. They were met with not only near water and in swampy places, but as often on the dry and bare ground in woods, and even among the houses in the villages. In February they are said to run about in families, although those which were found together never constituted a flock, or were followed until they flew up. Later in the spring some occurred to me which must have had their eggs among the fallen leaves in the aforesaid dry grounds; but this is only a conjecture. On two occasions the well-known cry of the snipe while flying was heard in the morning. It happened that no specimen was brought home, so that I have not been able to compare the species with European specimens; but as far as I could see on the spot, not the slightest dissimilarity was noticed. *Scolopax major* was not seen.

87. *Numenius arquata*, Lath. Of this bird also no specimen was brought home, but I saw it in the latter half of March, once shot and twice living, on the river banks. I did not hear it cry so loud or continuously as it is wont to do at the breeding season in Europe, but only with a shorter *heeee*! as one also often hears with us. Temminck also mentions (in his Manuel d'Ornithologie) that the Curlew occurs in India.

88. *Totanus glareola*, Temm. This Swedish species was also met with on the Ganges, and pursues the same mode of life as with us. In its stomach were found small snails. According to a rigid comparison it precisely resembles those of our climate, and I will therefore only give the measurements of a female, shot March 24. Beak to front 30 mill.; wing 135; tarsus 37; middle toe and claw 34; tail 50.

Near Sucsagor, on March 20—25, some other *Scolopacidæ* were seen, among which I thought I recognised *Totanus glottis* and *Limosa rufa* in their winter dress, but they did not occur very frequently. The species of *Parra, Charadrius, Ardea* and *Scolopax gallinago* seemed to be the most abundant waders in Bengal.

89. *Charadrius minor*, Meyer, occurred commonly near the

river in February and March; I have not noted its occurrence later. They ran upon the shores, commonly several together, but were not heard to cry. In the stomach they had much sand, with insects, larvæ, &c. The Hindoos called them *Ghorta gotta*. No difference was noticed between Swedish specimens and one brought from Calcutta. (♀ Beak to front 13 mill.; wing 113; tail 60; tarsus 22; middle toe 16, with the claw 19.)

90. *Charadrius cirripedesmos*, Wagl. Syst. no. 18 (?).

Griseus, subtus fronteque albus, pedibus elongatis rostroque nigris, remigibus omnibus fuscis, scapis plerisque albis; rectricibus fuscis, margine apicis albis, extima alba macula ante apicem fusca.

Adultus (♂ initio Maii) fascia pectoris latissima ferruginea (nigredine nulla). Frons late nigra, utrinque macula magna alba: albedo enim ordinaria frontis in medio divisa. Vitta ordinaria sub oculis ad aures, nigra. Vertex anterior cum superciliis pallide rufescens; nucha cum torque, in pectus descendente, ferruginea. Plumæ dorsi quædam margine sordide pallidiore. Long. 190 millim., rostrum e fronte 20, ala 125, cauda 54, tarsus 34, digitus medius 19, cum ungue 22. (♂ et ♀ similes; sed individua colore rufescente et maculis frontis albis paullo inter se differunt; quibusdam frons postice non nigra.) *Pullus* (♀ initio Maii) superne magis cinerascens, unicolor: caret coloribus nigris rufisque. Frons cum superciliis latissimis alba, vitta sub oculis, et fascia nebulosa, indeterminata pectoris, pallide fuscescentes. Pedes fusco-nigri. Longit. alæ 120 millim., cauda 48, tarsus 32, digitus medius 19, cum ungue 22. Est avis e sectione *Ch. hiaticulæ* affinis *Ch. cantiano*, sed pedibus longioribus. Ala mutica, tectricibus colore dorsi. Cauda paullulum superat alas. Remiges primæ fere pure nigræ; 6—8 extus in medio albæ: scapus primus totus albus, reliqui basi longius, apice brevius fusci.

On the river banks south of Calcutta this bird occurred in the beginning of May in large flocks, which however were now terminated, so that individuals migrated in flights. They were very common further down, eight or ten miles from the town, on the broad swampy shores left half-dry at ebb tide. Among several specimens shot in these flocks no two were exactly alike, the brown and black on the head and breast being somewhat variable. The young bird described above was shot some miles nearer the town. It was quite alone upon the shore, and none like it was got among the flocks, though I can safely assert its specific identity. Its plumage was perfectly formed, and it could hardly have been hatched the same year. The note resembled that of our small plovers, and was heard on two occasions when they flew up. In the stomach they had small crabs and insects.

Obs. On the river banks south from Calcutta, near Culpee for instance, I saw on my homeward voyage a great number of waders, most of which seemed to be plovers. Among others I

thought I saw *C. helveticus* and *Strepsilas collaris*. There were swarms of shore-birds, but I had unfortunately only a short hour to stay in the place and had no assistance. *Ibis Macei* and the *Charadrius* above-described were procured here.

91. *Larus ridibundus*, var. remigibus 3 anticis nigris, basi albis. ♀ d. 20 Aprilis (habitu perf. æstivali). Iris alba. Nigredo capitis, colore et limite, picturaque totius corporis exacte ut in individuis Suecanis tempore æstivo. Rostrum, pedes, palpebræ, remigum proportio etc. collata et simillima inventa; sed remiges 1^a et 2^a nigræ, basi et macula oblonga ante apicem alba (in aliis indiv. macula paullo major vel minor); 3^a nigra, basi latius alba, omnino caret macula alba; 4^a—6^a albæ apice late nigræ; sequentes et omnes cubitales dilute incanæ. Tectrices primariæ albæ, reliquæ colore dorsi. Longit. $15\frac{3}{4}$ poll. Ala 320 millim., tarsus 45, digitus medius cum ungue 43, cauda 118, rostrum e fronte 34.

Juniores? eodem tempore, ptilosi hiemali; capite albo, maculis solitis fuscis.

I did not see this bird before the middle of March, or at least it was not common; but in April and the beginning of May it was very abundant, so that whole flocks often made their appearance over the river. They seemed to live chiefly on the maggots which swarmed in the dead bodies in the river. The female described had her throat full of them, some of which were still living. Remains of fish were also found in the stomach. The cry, resembling laughter, was heard occasionally. The Bengalese name is *gangtjeel* (river-hawk), which is common both to gulls and terns, like the word *Fisk-måse* with us.

Obs. Another *Larus*, somewhat larger, much like *L. canus*, was seen sometimes on the river as well as in the sea off the coast. Of *Sterna* two or three species occurred, and one of them was common for a short time in April. It was larger than *S. hirundo*, with a shorter tail and white front, probably *S. cantiaca* of Raffles (Linn. Trans. vol. xiii.), but none such were procured. Another, seen in the Bay of Bengal, seemed like *S. minuta*, but of a grayer brown above; perhaps *S. panayensis*, as it could scarcely be *S. infuscata*, Licht., which is larger.

92. *Halieus africanus*.—Pelecanus africanus, *Gm.*, *Lath.* P. graculus β. *Lath.* Mus. Carlss. tab. 61 (? gula lutea). P. javanicus, *Horsf.*

Niger, gula alba, plumis scapularibus, tectricibusque minoribus cinerascentibus, atro-marginatis, acutis. Rostrum longitudine fere capitis. Rectrices 12, mediæ rostro quadruplo longiores.

♂ adultus (d. 24 Mart. testiculis parvis). Supra subtusque niger, gula sola alba. Collum antice, pectus et dorsum antice plumis grisescenti-marginatis. Plumæ scapulares oblongæ, elongatæ, acutæ, margine atro latit. $1\frac{1}{2}$ millim. Ala subtus atra: tantum caudæ basin

attingit. Cauda rigida, gradata. Pedes nigri. Rostrum fuscum, subtus pallidum. Longit. 20 poll. sv. Ala 198 millim., rostrum e fronte 34, tarsus 37, digitus externus cum ungue 62, cauda 143.

This small Cormorant, the least in the genus, was seen only in the lake near Sucsagor, ten [Swedish] miles north from Calcutta. It lived there in small flocks of from five to seven, and was not particularly shy, though difficult to shoot, for when I approached them they laid all their bodies under water, so that only the head and tip of the tail were seen above the surface. When fired at they dived, and rose again at a distance. The power of floating, in the manner mentioned, motionless in the water, exists also in many of our swimming birds, especially in young ducks, and is difficult to explain, as it seems to imply a specific gravity but little less than that of water, while the position of the bird in the ordinary mode of swimming shows that it is *then* at least twice as light*. When flying they resemble ducks. They were often seen sitting in trees near the water, or on roots, posts, &c. like those birds, but they were then more shy. The neck is commonly stretched out at full length. In the stomach they had fish and small crustacea.

This and the following species occur in the collection of Baron Gyllenkrok from Java, whence they were brought by Dr. Mellerborg.

93. *Plotus melanogaster*, Gm., Lath. p. 895 (cum var. δ). Pl. Levaillantii, *Temm. Pl. Col.* 380 (cum synonymia extricata).

Capite colloque fulvo-griseis, utrinque linea longitudinali alba; cauda tota nigra; plumis scapularibus nigris, linea alba notatis †.

Senior subtus niger; *junior* subtus rufesc.-griseus (♂ temp. propagationis crinibus laterum colli. Temm.).

♂ (d. 25 Mart. testic. parvis). Plumæ nullæ elongatæ colli. Corpus totum nigrum, subtus obscurius. Caput et collum ad truncum usque fulvescenti-grisea, fusco-punctata; gula et linea ex angulo oris ad medium collum, albæ. Linea e medio gutture ad alas fulvescens, nigredinem pectoris limitans. Cauda tota nigra. Alæ nigræ; plumæ scapulares longissimæ, lineari-acutæ, rigidæ, linea media alba, tectrices eodem colore, angustæ, acutæ. Iris griseo-flavescens. Rostrum fuscum, subtus flavescens. Pedes sordide virescentes. Longit. 32 poll. Suec. (collum 11, cauda 9). Rostrum 77 millim.

At the same place with the last species lived three or four of

* It is probable that in the case alluded to by Prof. Sundevall, the bird increases its specific gravity by ejecting a portion of the air contained in its pneumatic apparatus; or by partially condensing the air like the Nautilus and Ammonite.—H. E. S.

† *Pl. anhinga*, L.; cauda apice grisescente, capite colloque nigris vel griseis, absque linea alba; plumis scapularibus nigris, macula oblonga alba. Ex America: conf. Temm. loco supra citato. ♂ temp. propagationis nucha crinita.

these handsome though remarkably long-necked birds. They were commonly seen sitting in trees or upon posts in the lake, and seemed hardly to enter the water in quest of food. Here they were not so shy as they are described in Levaillant's 'African Travels.' I succeeded with some trouble in shooting one. When these birds sit, they have some resemblance to gallinaceous birds of the genus *Penelope*, but the long neck and the long straight beak give them a very peculiar appearance. The first I saw sat motionless on a post in the lake almost upright, with the wings half-opened, the neck curved somewhat like an S, and the long tail hanging straight down; it was as though I had seen one of the monstrous animals of mythology. The food consists of fish and crustacea, with which the stomach of the specimen which I shot was filled. In the wide œsophagus were many curious intestinal worms. The Bengalese name is unknown to me. This species is found in all the warm parts of the old continent, and in the Indian islands. The warm regions of America have another species, very little different, and no more species of *Plotus* are known.

94. *Anser* ——. Anas indica et cana? *Gm., Lath.*; an A. ægyptiaca, *auct.*?

Dilute rufescens, speculo alarum viridi nigricanti. Magnitudo *Anseris albifrontis.*

Near Sucsagor at the end of March a considerable flock of small reddish geese frequented the banks of the river. They were said to come there yearly, but depart during the hot season, so that they probably migrated soon after I saw them. Like all geese they were very wary, so that in spite of every effort I did not succeed in shooting any, though I managed to observe them tolerably with the help of a telescope. Their note was a cackling rather like that of common wild-geese, but rougher and shorter. The Bengalese name is *Raz hangs* or *Loll hangs*. The word *hangs* is sounded like the French pronunciation of *hanse*, and is the common name for geese and ducks. *Loll* signifies *red*.

95. *Anser* —— *domesticus*. (Rostrum totum pallide rubicundum, longitudine capitis, basi gibbosum, pone medium fortius depressum, leviter deflexum. Pedes colore rostri. Caput superne et nucha (plerumque) castanea, limite definito, ut in *A. cygnoide*. Cauda alas æquans. Cutis inter pedes nunquam dependens. Magnitudo et statura *A. cinerei.* Corpus cinerascens (anserinum) subtus albidum, sed color sæpe alius.)

The tame geese were in general somewhat unlike those which occur with us. The beak had a large knob above the base, and the hind neck a sharply-defined brown colour, as in the so-called Turkish [Chinese] geese (*Anser cygnoides*), but the beak and feet were the same colour as in our tame geese. It is probably a

mixed race. The voice was also somewhat harsher than in the common goose.

96. Tame ducks (*Anas boschas*), as well as geese, are kept by the naturalized Portuguese and by the Musselmans, but not by the Hindoos. Perhaps both these domestic birds were introduced from Europe. I did not see *Anas boschas* wild.

97. *Anas caryophyllacea*, Lath.—A. javanica? *Horsf. Linn. Tr.* xiii. A. castanea, *Mus. Holm.*?

Rufescens, dorso nigricante, plumis subtruncatis, griseo-marginatis; ala subtus nigra, superne tectricibus minoribus ferrugineis. Rostrum nigricans ungue lato, adunco.

♀ (Calcutta Martio). Caput superne griseo-fuscum, lateribus et collo testaceo-griseis; jugulum dilutius, nucha obscurior, gula alba. Dorsum fusco-nigrum, antice plumis obtusis latis griseo-marginatis; postice immaculatum. Gastræum dilute rufum, non maculatum, crisso albido. Cauda nigra, tectricibus superioribus rufis. Alarum remiges nigro-fuscæ; tectrices maximæ, etiam primariæ, nigro-cinereæ, nullum speculum formantes. Rostrum fuscum, pedes plumbei. Longit. 15 poll. Ala 192 millim., tarsus 40, digitus medius 60, rostrum e fronte 37, cauda 42.

Rostrum longit. fere capitis, angustius, basi latitudine multo altius; lamellæ suboccultatæ; unguis validus, abrupte perpendiculariter deflexus, apice rotundatus margine acuto. Alæ breves, caudæ basin attingunt; remiges 2—3 subæquales, reliquis longiores. Cauda brevissima rotundata. Pedes postici, subelongati, tarso reticulato, digitis longis, scutatis, membrana non excisa. Pollex non lobatus longus, æqualis articulo primo digiti externi.

♂ (an junior? Martio) similis feminæ sed coloribus saturatioribus, nucha nigricante. *Tectrices nullæ arcuatæ* *.

This seems to be the commonest species in Bengal; it occurs both single and in flocks on every piece of water in the country, and lives on plants. The specimens examined had in their stomachs remains of the same sort of vegetables as those noticed under *Parra indica*. They had a strong muscular gizzard and a large pouch in the œsophagus. The voice is a rough, very short *grah*! *grah*! The Hindoos merely called this bird *Hangs*.

98. *Anas querquedula*, Linn., Temm., Nilss. (♂ habitu perf. hiemali, testiculisque minutis, d. 25 Martii.)

I shot a male of our common Teal, which on comparison showed no difference from Swedish specimens. Several were seen near

* *Individuum e Tranquebar* in Mus. Hafniensi differt: capillitio pallidiore, rufescenti; collo medio undique cinereo-variegato; vitta nuchæ ad dorsum extensa, nigra, hypochondriis albo-maculatis.

Indiv. e Java, Mus. Gyllenkr. (certe *A. javanica*, Horsf.), differt capillitio nigro, coloribusque rufis multo saturatioribus.

Calcutta, and the species was said not to be rare in that quarter. The natives knew it by the name of *Bigri hangs*.

99. *Anas coromandeliana*, Gm., Lath. 106. Alæ nigricantes remigibus omnibus apice albis, subtus alba. Pollex tenuis. ♂ superne viridis nitens; ♀ superne fusco-cinerea. Minor quam *crecca*.

This pretty little Duck is easily recognised even during flight, by a white margin to the wings, formed by the tips of all the quills. The male is of a fine grass-green above. It is common on the river, but I only procured a pair, which shared the same fate as the Lark, no. 28, above-mentioned;—they were destroyed by ants during the night. They had only fed on vegetables.

[To be continued.]

XXII.—*Descriptions of new or imperfectly described Lepidopterous Insects.* By Edward Doubleday, Esq., F.L.S., Assistant in the Zoological Department of the British Museum, &c.

[Continued from vol. xviii. p. 376.]

Genus Ornithoptera.

Orn. Poseidôn. Alis supra holosericeo-viridibus, limbo nigro, anticis fascia longitudinali latissima nigra, nervulis viridibus divisa; posticis subtus aureo-viridibus, angulo ani aureo. Exp. alar. $6\frac{1}{2}$ unc. vel 168 mill.

Hab. Darnley Island.

Above, anterior wings with the entire limb deep velvety black, the disc occupied by a broad fascia of the same colour united to the black margin below the apex, divided by the median nervure and nervules, which are golden-green, its inner side more fuscous and opake. The space between this and the limb is occupied by two vittæ of a bright golden or satiny green, shading to bright coppery. The upper of these is narrow at the base and becoming gradually wider until near the apex of the wing, when it suddenly narrows. The lower follows a direction parallel to the inner margin until near the anal angle, gradually widening to this point, when it is bent abruptly upwards; and becoming somewhat macular, terminates near the second discoidal nervule. Posterior wings small, triangular, the anterior and outer margins rounded; satiny green with coppery reflections, the limb narrowly black, the outer angle with one or more round black dots, and generally near the outer margin is a series of round orange spots between the nervules.

Below, the anterior wings have the limb black, broadest on the costa, with a slender green vitta below the third and also the fourth subcostal nervule, all the interstices below the fifth sub-

costal nervule occupied by a large green patch, each divided except the first by a black spot, these spots forming an irregular transverse fascia. Cell black, the lower half almost occupied by a golden green vitta extending from near the base to the end of the cell. Posterior wings golden green, the golden colour predominating externally; the anterior and outer margins black, the former with one, the latter with five black spots, the costal spots sometimes preceded by an orange dash; the anal angle broadly golden yellow.

Head and thorax black, the latter with a long golden green vitta above. Abdomen golden yellow.

In the cabinet of the British Museum.

This beautiful insect differs from *Orn. Priamus* in the different form of the green vittæ of the anterior wings, in the golden green colour of the median nervure and nervules, in its much smaller posterior wings less broadly bordered with black, in the golden green hue of its posterior wings below, and especially in the large golden orange patch at the anal angle (which is black in *Orn. Priamus*), and the suffusion of the same colour along the outer margin.

It was found abundantly by Mr. Jukes on Darnley Island, amongst the cocoa-nut groves.

Genus Papilio.

P. Zagreus. Alis anticis elongatis nigris, vitta in cellulam fulva, fasciisque macularibus fulvis, ochraceisque, posticis obtuse dentatis fulvis, maculis disci, fimbriaque postica, in qua maculæ sex ochraceæ, nigris. Exp. alar. 5 unc. vel 127 mill. Doubl. & Hewits. pl. 1*

Hab. Venezuela. & Eg.

Anterior wings elongate, rounded at the apex, the inner margin slightly concave, black: the cell with a transverse ochraceous band near the end, and a bright fulvous vitta at the base, extending along the upper side of the median nervure beyond its second nervule: beyond the cell is a macular band composed of seven spots; the first, near the costa, triangular, the second rhomboidal, the third, fourth, fifth and sixth subtriangular, the apex directed outwards, the seventh oval; of these the first four are ochraceous, the others fulvous: between this band and the cell is a large fulvous spot divided into three parts by the first and second median nervules, and only separated from the vitta by the median nervure: near the apex four subovate ochraceous spots, the third longest, placed so as to form an oblique macular band, and below these near the outer margin four small spots of the same colour.

Posterior wings oval; the outer margin with four short, rounded teeth; fulvous, the outer margin broadly black, in which

are six small ochraceous spots; the interstice between the costal and subcostal nervures marked with a black vitta: a black cloud at the end of the cell and in each of the interstices of the nervules. Below, the anterior wings as above, but paler, the posterior with the markings of the disc more distinct; the marginal band fuscous posteriorly, black anteriorly, where it is marked by two pure white dots in each interstice.

Head large, black, the vertex with two white dots, palpi and orbits white. Antennæ ochraceous, the base black.

Thorax very robust, black above, with an ochreous line down the middle; three spots of the same colour on each side near the base of the wings, two white dots on the prothorax: below ochreous, striped laterally with black; legs black; coxæ striped with ochreous.

Abdomen robust, elongate, brown above, more fulvous below, where it is marked with a median black line.

In the cabinet of the British Museum.

This extraordinary insect is without exception the most remarkable *Papilio* yet found in the New World. In form and colouring it so closely resembles the Heliconian butterflies of the same group as *Hel. Eva*, that but for its robust body it might easily be mistaken for one of them. Its pale antennæ are a remarkable character; for I only know one other species of true *Papilio* (*P. Antenor*) in which the antennæ are of any other colour than black except some small spot at the base or apex; but here we have them precisely resembling those of *Hel. Eva* in colour. Whilst however it possesses these subordinate characters of the Heliconians, it has all the essential characters of *Papilio*, or I might say of *Ornithoptera*; for in the form of the head, thorax and abdomen, it comes nearer to *Orn. Priamus* than to any true *Papilio* I am acquainted with.

The only specimen I have ever seen was found in Venezuela by Mr. Dyson, whose indefatigable exertions as a collector merit the highest praise.

Genus Amathusia.

Am. Amythaon. Alis omnibus supra fuscis, anticis fascia obliqua lata læte cærulea (in ♀ fulva); subtus pallide chocoladinis, strigis plurimis transversis saturatioribus, posticis ocellis duobus albo pupillatis. Exp. alar. 5 unc. vel 122 mill.

Hab. Silhet.

Above, all the wings fuscous black, darker, especially the posterior near the base; the anterior traversed by a broad oblique band of a beautiful light blue, with purplish reflections, commencing on the costa above, opposite to the middle of the cell, and occupying in width about one-third of the costa, extending obliquely across to the submedian nervule, and terminating near

the outer margin, where its upper boundary is the second discoidal nervule. Below, all the wings pale chocolate, with lavender reflections, traversed by seven transverse lines; the first commencing on the costa of the anterior wings near the base, continued along the precostal and first median nervule of the posterior wings, the second continued across both wings to the origin of the second median nervule of the posterior wings, the third short, just crossing the cell a little beyond the middle, the fourth beyond the cell, continued nearly to the anal angle, the fifth more oblique, only reaching the first median nervule of the posterior wings, the sixth arising near the apex, meeting the fourth at its termination, the seventh submarginal, common. Posterior wings slightly produced into a short, round tail or palette at the anal angle, having besides the markings already described two ocelli composed of an oval black ring with a white pupil, the larger one near the costa between the first and second subcostal nervule, the second between the first and second submedian nervule at the point of junction of the fourth and sixth strigæ, the anal palette with two black dots edged with white. Cilia all white.

Head, thorax, and abdomen brown.

Female paler, with the band of the anterior wings much narrower, not occupying any part of the cell, fulvous, marked near the outer margin with a brown waved striga.

In the cabinet of the British Museum, &c.

Much resembling in form *Amathusia Phidippus*, but known at once by the blue band above and different markings of the under surface. The blue band of the anterior wings gives it a considerable resemblance to *Zeuxidia Luxeri* of Hübner, but it wants the blue on the posterior wings, and is totally different below.

XXIII.—*Note on the Irish species of* Cephaloptera (Pterocephala). By Frederick M'Coy, M.G.S. & N.H.S.D. &c.

[With a Plate.]

On looking over some memoranda lately, I found the following notes and drawing, Pl. XI., made some years ago, of the specimen of *Cephaloptera*, originally noticed by Mr. Thompson of Belfast, in the Museum of the Royal Dublin Society, and which may be interesting to naturalists, as the specimen is still, so far as I know, not only unique as Irish, but even the genus to which it belongs has not been observed before or since in the British seas; and further, the specimen seems to be erroneously referred to in most works on British zoology.

I wish here to acknowledge the liberality with which Dr.

Scouler, Lecturer on Geology and Keeper of the Museum to the above Society, has always permitted me to examine and describe any objects which interested me in the Museum under his care; and he it was, I believe, who first drew Mr. Thompson's attention to this most interesting addition to the British fauna, and noted its genus.

The specimen in question was first publicly noticed by Mr. Thompson in a communication to the Zoological Society of London (Proc. June 5, 1835), and the particulars which he gives of its capture on the Irish coast are all I know on that point, having failed in my inquiries for any information in addition to that which has been published on his authority. That gentleman however neither described nor figured the specimen, merely noticing its general resemblance to the figure given by Risso of the *Cephaloptera Giorna*; subsequent writers seem to have in some manner mistaken the passage, as they make the reference to that species decisive, which, as I have stated, was not the case in the original notice.

I might here suggest, that according to the rule of priority, Dumeril's name *Cephaloptera* should not be retained for this genus, having been previously used by Geoffroy St. Hilaire for a genus of *Coracinæ*, formed for the reception of that remarkable bird the *Coracina cephaloptera* of Vieillot; it has been proposed to alter the name of the genus of Fish to *Pterocephala*, which it would be well to adopt.

On examining this very interesting specimen, I found that although obviously a *Pterocephala*, yet it presented most important differences from the *C. Giorna*, both in outline, proportions, shape of the fins, and form of the wing-like appendages to the head; neither does it agree with any of the European or American species described by modern writers, so far as I have seen, but seems referable to that described many years ago, from the coast of Tuscany, by Dr. Fabroni of Florence, and figured by Lacepède under the name of *Raja Fabroniana* in honour of its discoverer. This species seems to have been lost, Cuvier and most other ichthyologists throwing a doubt on its existence, and supposing the figure referred to, to represent a mutilated example of the common *C. Giorna*; it is therefore doubly interesting to rediscover it in our own seas, as an addition to the fauna and as replacing an old species in the systems. The *P. Fabroniana* differs from the *P. Giorna* in the length of the body (exclusive of the whip-like tail) being nearly one-half of the width from tip to tip of the pectoral fins, while the length is not more than one-third of the width in the latter species. Besides this great proportional width of the *P. Giorna*, its pectorals are much narrower than in the present fish, and nearly straight, while in the *P. Fabroniana* they are

broadly falcate, recurved, and without any fin-like margin on the anterior edge. The appendage to the head forms a semicylindrical process in the *P. Giorna*, but forms two horn-like fins, one on each side of the head, in the Irish fish and in Fabroni's Mediterranean one; those are represented in the figure sent to Lacepède and engraved in his work, with I think rather too many turns, being twisted into regular conical horns; the corresponding parts in the specimen under consideration show also a strong tendency to roll spirally, but not amounting to more than I have represented in the sketch; this is however a matter easily exaggerated by an artist, or the difference of age and sex would very probably make a difference in the length and consequent inrollment of those parts.

Dr. Fabroni's species is defined as a "falciformly dilated brown ray, whitish beneath," &c.; this colouring agrees exactly with our specimen, but differs entirely from that of the *P. Giorna*: another point of agreement between the two former specimens is the extreme slenderness of the tail, it not being more than half the thickness of that of the *P. Giorna*; the tail in both specimens of the *P. Fabroniana* is defective as to all that portion from the barbed spine to the tip, so that the exact position or form of the spine is unknown. The figure given by Lacepède is of the under-side only; it agrees however very well in the general form and proportions, broad, recurved pectoral fins, frontal processes, and the small size of the tail.

There is a very strong resemblance also between the present fish and the Indian *Cephaloptera Kuhlii* (Valenc.) as figured by Müller and Henle in their 'Systematische Beschreibung der Plagiostomen,' &c., as may be perceived by comparing the sketch I have given with their drawing, particularly in the form of the lateral processes of the head and the general proportions of the body; but our specimen and Dr. Fabroni's seem to differ from that species in the small size of the head and some minor points, in addition to the difference of habitat.

Length (of the Irish specimen) from the front to the dorsal fin 1 foot 8 inches; entire width 3 feet $8\frac{1}{2}$ inches; height of dorsal fin $2\frac{1}{2}$ inches, length the same; from one eye to the other 8 inches.

Cambridge, 12th January 1847.

XXIV.—Drafts for a Fauna Indica. By Ed. Blyth, Curator of the Asiatic Society's Museum, &c. &c.*

[Continued from p. 108.]

The Doves

Are generally smaller and more delicately formed, with the tail commonly more or less lengthened and graduated, this latter character attaining a high degree of development in certain groups of them. The nearest approach to the wood-pigeons is exhibited by the North American passenger doves (*Ectopistes*, Sw.), which are especially characterized by having a long, much graduated and sharp-pointed tail, and powerful wings, of which the first two primaries are equal and longest; they have the true pigeon-like play of colours on the sides of the neck. The African *Œna capensis* has been generally placed near *Ectopistes*, but (so far as can be judged from drawings) would appear rather to approximate certain of the *Macropygiæ* of the Eastern Archipelago, as *M. Reinwardtii*. To the last-named group one Indian species appertains.

Macropygia, Swainson: *Coccyzura*, Hodgson. (Cuckoo-doves.)

The species of this division are remarkable for their very broad, long and much graduated tail, and general Cuckoo-like figure. They chiefly inhabit the great Eastern Archipelago, a single species occurring in the Himalaya, and another in Australia. For the most part they are confined to rocky upland forests, and subsist much on berries, often descending to the ground to pick up fallen mast and fruits; upon being disturbed, their great broad tail shows to much advantage as they rise. The species of the Archipelago are very injurious to the pepper and other spice plantations; and their flesh is highly esteemed for the table, from the fine flavour said to be imparted to it by the various aromatic berries on which they feed.

M. leptogrammica: *Col. leptogrammica*, Temminck, Pl. Col. 248: *Coccyzura tusalia*, Hodgson, Journ. As. Soc. xiii. p. 936. (Rayed Cuckoo-dove.) Upper parts dusky, with numerous narrow rufous bars on the mantle, wings, rump and upper tail-coverts; tail more obscurely barred in the male; forehead, chin and throat whitish, tinged with lake; the occiput, neck and breast dull pale vinaceous, glossed (less brightly on the breast) with changeable green and amethystine-purple; lower parts yellowish-albescent, the under tail-coverts pale buff; all but the four middle tail-feathers ashy, with a broad black subterminal band;

* From the Journal of the Asiatic Society of Bengal, no. 169.

and above this band the exterior web of the outermost tail-feather is whitish. Female having the tail barred with narrow rufous cross-lines, like the rest of the upper parts; and the fore-neck and breast are similarly rayed with alternate dusky and pale buff. The tail-feathers, more especially of the female, have their inner webs rufous at base. Bill black; cere, orbits and legs red. Wings $7\frac{1}{2}$ to 8 inches; middle tail-feathers the same, the outermost $4\frac{1}{2}$ inches.

The above descriptions are taken from a fine characteristic male and female; considerable variation of plumage occurring, as many specimens are in different degrees intermediate. This bird inhabits the Eastern Himalaya, and is common at Darjeeling.

Turtur, Selby. (The Turtle-doves.) (*G'hoogoo*, Bengal; *Fachtah*, H.; *Gya*, Arracan.)

Small and delicately formed tree-pigeons, with the tail moderately graduated or merely rounded, having always broad gray or grayish-white tips to its graduating outer feathers; neck devoid of iridescent gloss. They feed chiefly on the ground, upon grain, small pulse and oil-seeds; assemble in small flocks except when breeding, and generally prefer groves and coppices which intersperse the open country, coming much into gardens, where sometimes they may be seen nearly as familiar as domestic pigeons. In such situations they breed abundantly, constructing the slight platform-nests common to all arboreal *Columbidæ*; and in warm climates they have no special season for propagation, but produce alike at all times of the year, the same as domestic pigeons. As compared with the large true wood-pigeons, these birds are certainly much more terrene in their habits*; but they grade towards the wood-pigeons in *Turtur picturatus* (*T. Dufresnii*) of the Isle of France, which however is a true turtle-dove, having merely a larger bill than its congeners. Their geographical range is confined to the old world, inclusive of Australia, and the only Australian species (*T. humeralis*) is coloured like the *Geopeliæ*; which last are indeed but a subgenus of the present group, consisting of smaller and more slender-formed species, with delicate rayed plumage, and which are confined in their distribution to the Malay countries and Australia†.

* They resemble the generality of more dove-like *Gourinæ* (as do also the rock-pigeons) in having the outer toe shorter than the inner, which, accordingly, would indicate a terrene propensity.

† *G. striata* (v. *Col. sinica, malaccensis, bantamensis*, &c.), common in the Malay countries, appears also to inhabit the Mauritius. Living specimens are occasionally brought to Calcutta, where I have kept both it and *T. humeralis*; and being thus familiar with both, I do not agree with Messrs. Gould and G. R. Gray in making a *Geopelia* of the latter. It serves, however, to show the immediate connexion of the two subgroups.

G. humeralis agrees with *G. striata* in having the first primary suddenly

T. RISORIUS: *Col. risoria,* Linn. (*Kālhāk, Kăhălăk, Kahalaki,* or *Pánr G'hoogo,* Beng.; *Dhor Fachtah,* S. India.) (GRAY TURTLE-DOVE.) Uniform light gray-brown; the edge of the wing and lower tail-coverts pure ashy, somewhat deeper on the latter; head delicate pale vinous-gray, whiter on the forehead and throat; the nape and under-parts less ashy and more vinaceous, passing to light grayish towards the vent; a narrow black half-collar on the hind-neck; primaries dusky, with slight whitish margins bordering their tips; and closed tail uniform with the back above, all but its middle feathers successively more distinctly marked with black about the middle, passing into grayish on the basal half, and to white on the terminal, successively more strongly pronounced. Irides crimson; bare orbital skin white; bill black; feet dark pinkish-red. Length 13 inches by 20 or a trifle less; wing $6\frac{1}{2}$ inches, or sometimes rather more.

Common and generally diffused, frequenting hedges and trees in the neighbourhood of cultivation, and even low bush-jungle: it inclines more to be gregarious than the other species. To the eastward however it seems to be unknown in Arracan. According to Mr. Strickland, the identical species occurs in Northern Africa; and it is likewise stated to inhabit the south-eastern part of Europe, as Hungary, Turkey, and the islands of the Lower Danube*. In Southern Africa it is replaced by a nearly-allied species, the *Col. vinacea,* Gmelin, to which Mr. G. R. Gray refers *T. erythrophrys* of Swainson, while Mr. Strickland identifies the latter with *T. risorius,* and considers *T. semitorquatus* of Swainson to be the *vinacea*†. Mr. Gray, again, does not mention *semitorquatus* of Swainson, but gives *semitorquatus,* Rüppell, as distinct from either. *T. vinaceus* is distinguished from *T. risorius* by its generally much darker colour, by having the under tail-coverts whitish instead of deep ash, by its much broader black nuchal semi-collar, and by its winglet and primary coverts being dusky instead of pale ash-gray. It is also rather smaller than the Indian species; in which respect, and in the breadth of the nuchal half-collar, the common tame cream-coloured (or pale buff-backed) doves, which are abundantly bred in captivity both in Europe and in India, agree with the South African rather than with the wild Indian species. As for Swainson's two alleged species, I can identify neither of them satisfactorily; his figure

narrowed on both webs near the tip (a character which does not exist in *Turtur*), and I therefore consider *humeralis* to be a true *Geopelia.*—H. E. S.

* Bull. de l'Acad. des Sciences de Saint Pétersburg, 1837, No. 46; as quoted in the Rev. Zool. par la Société Cuviérienne, 1838, p. 293.

† Vide Strickland in Ann. & Mag. N. H. 1844, p. 38; Gray's illustrated 'Genera of Birds'; and Swainson's 'Birds of West Africa,' vol. ii., Nat. Libr.

of *T. erythrophrys* is evidently faulty in the colouring; but he speaks of "the belly, flanks, vent and under tail-coverts" as "clear cinereous," which should distinguish it from *T. vinaceus*, while its "*broad* black semi-collar, margined by a narrow cinereous line," instead of a slight grayish-white one, should equally separate it from *T. risorius*; again, "the orbits are naked and rich red," which applies to neither of them: his *T. erythrophrys* has the wing 7 inches, and his *T. semitorquatus* only 5½ inches, both the Indian and South African species being in this respect intermediate. *T. semitorquatus* has, further, "the belly, vent, thighs and under tail-coverts cinereous-white," which agrees sufficiently with some specimens, apparently females, of *T. vinaceus*, the (presumed) males having at least the abdomen scarcely paler than the breast; but, "above all, the inner toe is one-twentieth of an inch *longer* than the outer," whilst "in *erythrophrys* this proportion is almost reversed, or at least the inner toe is not even equal to the outer." In both the Indian and South African birds the inner toe is shorter than the outer*.

Besides the common cream-coloured domestic race, a small albino variety is frequently bred in cages, in different parts of India, with wing measuring 5½ to 6 inches; but its form of tail and other proportions are as in *T. risorius* and *T. vinaceus*. This bird is often interbred with the cream-coloured race, producing offspring of intermediate size and shade of colouring†. The *coo* of *T. risorius* somewhat resembles the sound *cuckoo*, pronounced slowly and with a pause between the syllables, the second being much prolonged and at first rolled. It may not unfrequently be heard in moonlight nights.

T. HUMILIS: *Col. humilis*, Temminck: *Asiatic Pigeon*, Latham. (*Serotee Fachtah*, Hind.; *Golabee*, or rose-coloured, *G'hoogoo*, *Támákhŭree*, or copper-cup, and *I'tkŭiyá*, or brick-coloured—Dove, Beng.; *Goodko*, *G'hoogoo*? i. e. Dove, Scinde; *Gyoleng-bya*, Arracan.) (RED TURTLE-DOVE.) Much smaller and of a less elongated form than the last; general colour fine

* Notwithstanding these apparent inconsistencies, I have no doubt that *erythrophrys* = *risorius*, and *semitorquatus*, Sw. = *vinaceus*. The breadth of the nuchal collar, and even the apparent nakedness of the orbits, greatly depend on the stretching of the skin in preparing the specimen. I have an Indian specimen of *risorius* which exhibits a wide ring of bare skin round the eyes, solely from their being filled with too much cotton. In this specimen the wing measures 7 inches, as in the description of *erythrophrys*. My specimens of *vinacea* from South Africa have the inner toe (including the claw) conspicuously longer than the outer, as is stated of *semitorquatus*.

N.B. The *Turtur semitorquatus* of Rüppell is a distinct species, much like *risorius*, but larger and otherwise different.—H. E. S.

† The "Jungle Pigeon" of Latham would seem to be merely a domestic variety of this kind.

vinous-red, weaker below; the head ash-gray, paler towards the forehead, and whitish on the chin; a black half-collar on the nape; the rump and upper tail-coverts dusky-ash; vent and lower tail-coverts white, the former tinged with ashy; middle tail-feathers ash-brown; the rest successively more broadly tipped with white, which spreads up the whole exterior web of the outermost feather, and their basal two-thirds (more or less) blackish; margin of the wing gray for the anterior half; the primaries and their coverts dusky, and the secondaries grayish-dusky. Irides dark brown; bill black; legs purplish-red. Length 9½ inches, and of wing 5¼. Female rather smaller. The young nearly resemble the adults of *T. risorius,* except in their much smaller size, their general darker colour, especially upon the head, and in wholly wanting the vinaceous tinge: in this state of plumage they doubtless constitute the supposed small race of *T. risorius* mentioned by Major Franklin.

The Red Turtle-dove is generally diffused over the country, though much less numerously than the gray one. It also keeps more to cover, frequenting groves and high thick hedges. Its coo is short and grunt-like.

T. SENEGALENSIS: *Col. senegalensis,* Linn.: *C. cambaiensis,* Gmelin: *C. ægyptiaca,* Latham: *C. maculicollis,* Wagler:—figured, but not well, and much over-coloured, in Denon's 'Egypt.' (*Tortroo Fachtah,* Hind.) (NECKLACED TURTLE-DOVE.) Brown above, the wing-coverts (except towards the scapularies) pure light gray; winglet, primaries and their coverts dusky, the secondaries tinged with gray; head, upper part of neck and breast pinkish-vinaceous, paler below, and passing to white on the belly and lower tail-coverts; the sides of the neck anteriorly (and meeting imperfectly in front) adorned with a large patch of furcate feathers, black at base, with a round rufous spot on each tip; in the living bird, these hardly appear at all when the neck is drawn in; and unlike the preceding species, there is no bar or other marking on the nape; tail graduated to the depth of an inch, and its feathers attenuate a little towards their tips; the middle tail-feathers are brown; the rest white for the terminal half, or nearly so, and black for the remainder. Irides dark, with a white inner circle; bill blackish; legs lake-red. Length 10 inches or 10½ by 14 inches; closed wing 5 inches.

This delicate little species abounds in most parts of the peninsula, also in Western and Upper India generally, and it inhabits the Rajmehal and Monghyr hills in Bengal; but in Lower Bengal I have never seen or heard of it wild, nor does it appear to occur in the Himalaya or in the countries to the eastward. In the peninsula, according to Mr. Jerdon, "it abounds both in low jungles and near villages and cantonments, being found especially

towards the north in every garden, and frequenting stable-yards, houses, &c." Like *T. risorius*, it is common to India and North Africa; and Mr. Strickland states that it "inhabits the Turkish burial-grounds at Smyrna and Constantinople, which are dense forests of cypress-trees. It is strictly protected by the Turks, and it was with some difficulty," he adds, "that I could obtain a specimen. It was perhaps originally introduced there by man, but now seems completely naturalized*." The coo of this species is low, subdued and musical, a dissyllabic sound repeated four or five times successively, and of which its Hindoostanee name *Tortroo* is a sort of imitation†.

T. SURATENSIS: *Col. suratensis*, Gmelin, founded on *la Tourterelle de Surate* of Sonnerat: *C. tigrina*, Temminck: *C. turtur*, Linn., var., figured in Griffith's 'Animal Kingdom,' viii. 290. (*Chitroka Fachtah*, Hind.; *Chanral G'hoogoo*, or *Telia G'hoogoo*, Beng.; *Kangskiri*, Bhagulpore; *Chitla*, Upper Provinces; *Laybyouk*, Arracan.) (SPECKLED TURTLE-DOVE.) Above blackish or dusky, each feather having two pale rufous terminal spots, which latter enlarge and spread up each side of the feather, upon the wing-coverts, the blackish contracting to a central streak, with broad pale vinaceous lateral borders; edge of the wing light gray; head grayish, tinged with vinaceous, which latter prevails on the breast and under-parts, passing to white on the belly and under tail-coverts; a broad half-collar on the nape, consisting of black feathers divergent at the tips, each tip ending in a small round white spot; tail broad and graduated to the depth of an inch and a half or more, each feather attenuating towards its tip; the middle tail-feather brown, the outermost grayish-white for nearly the terminal half, having the rest black, and the other tail-feathers successively intermediate in their colouring. Irides dark hazel, surrounded by a reddish *sclerotica*; beak dull leaden-black; legs dark purplish-red. Length 12 inches by $16\frac{1}{2}$; of wing $5\frac{3}{4}$ inches; female rather less.

A very familiar species, and generally diffused both throughout India and in the Malay countries, coming very much into gardens even of large towns. It abounds even more than *T. risorius* in the vicinity of Calcutta, where it inhabits every patch of garden; *T. risorius* keeping generally a little away from houses. Its coo is musical and pleasing. Mr. Jerdon mentions having "seen a nearly albino variety once or twice of a pinkish-white colour throughout." This species has been erroneously identified with

* Proc. Zool. Soc. 1836, p. 100.

† African and European specimens are larger than the Indian ones, the wing measuring $5\frac{1}{4}$ inches. I have one from the Cape of Good Hope, identical with a Turkish specimen, and more rufous on the back than the Indian bird.—H. E. S.

the *T. chinensis* (*Col. chinensis,* Scopoli, vel *C. risoria,* var. B, Latham), founded on *la Tourterelle grise de la Chine* of Sonnerat, by whom it is correctly figured. The latter is distinguished by its larger size, having the wing and tail respectively six inches long; by the deep ash-colour, instead of white, of its lower tail-coverts; and especially by having the back and wings plain unspotted dark brown, with merely a slight tinge of gray at the bend of the wing only; the spotting of the nape is precisely similar. This bird inhabits China, and the Society possess a specimen of it from Chusan.

T. MEENA: *Col. meena,* Sykes, Proc. Zool. Soc. 1832, p. 149: *C. agricola,* Tickell, Journ. As. Soc. ii. 581: very closely allied to, if not identical with, *C. orientalis,* Lath., founded on *la Tourterelle brune de la Chine* of Sonnerat, which is certainly also *C. gelastis,* Temminck, Pl. Col. 550. (*Kullah Fachtah,* Hind.; *Sám G'hoogoo,* Beng.; *H'hulgah* of the Mahrattas; *Gyo-pein-doo-ma,* Arracan.) (FOX-COLOURED TURTLE-DOVE.) Vinaceous-brown, lighter on the belly; more or less ruddy, ashy, or even duskyish above; the rump and upper tail-coverts deep gray; vent and lower tail-coverts lighter gray; crown and forehead more or less ashy, passing to whitish towards the bill; throat also whitish in some specimens; on the sides of the neck a patch of black feathers, margined with grayish-white, forming a series of three or four lines of the latter hue; scapularies, and a greater or less proportion of the wing-coverts, black, broadly margined with rufous all round their tips; coverts of the secondaries pale bluish-ash, at least in some specimens; winglet and primaries with their coverts dusky, the primaries slightly edged with whitish; tail dusky-ash, its outer feathers successively more broadly tipped with whitish-ash, whiter on the outermost and beneath; irides orange. Length about $11\frac{1}{2}$ inches; of wing commonly 7 inches.

This bird is also pretty generally diffused throughout India, and occurs upon the Himalaya as a summer visitant, arriving in pairs towards the end of March, as I am informed by Capt. Hutton. Mr. Jerdon observed it to be tolerably abundant in the forests of Goomsoor, south of Cuttack, associating in flocks of various sizes. It is enumerated by Mr. Elliot, he adds, as found in the Southern Mahratta country, but was not observed by himself in the forest of Malabar. In the Himalaya, and in the eastern countries of Assam, Sylhet and Arracan, it appears to be plentiful, inhabiting alike the hills and plains; and it is common in the Bengal Soonderbuns. A Javanese specimen is rather large, and very dull-coloured; less vinaceous underneath, with more gray on the head, and less rufous margining the feathers of its mantle, than in any Indian specimen I have seen; never-

theless, the species is probably identical*. It is nearly allied to *T. auritus*, Ray (*Col. turtur*, Linn.), of Europe, which it resembles in its manners and in its coo, but is distinguished by its superior size; "orange irides instead of yellow; by the whole head (in some), neck, shoulders, breast and belly being richer vinaceous; in the back and rump being ash, and vent and lower tail-coverts light cinereous," &c. The specimens of *T. auritus* from India and China, mentioned by Latham, may accordingly be presumed to have been of the present species. Another nearly-allied dove would seem to exist in *la Tourterelle cendrée de l'Isle de Luçon* of Sonnerat, upon which are founded *Col. cinerea*, Scopoli, and *C. turtur*, var. C, of Latham. Living specimens of the present species, and of the gray, red and speckled turtle-doves, also of the ground dove and of *Treron phœnicoptera* and *Tr. bicincta*, are almost always to be seen for sale at the shops of the Calcutta bird-dealers.

Memorandum.—The only known Indian Pigeons now wanting to the Museum of the Asiatic Society, Calcutta, are *Columba Elphinstonii* and Himalayan specimens of *C. palumbus*; also females of *Treron cantillans* and of *Carpophaga insignis*; and good specimens of *Col. leuconota* are acceptable, as also of *C. pulchricollis*. Of species that require verification, there remain the *Treron pompadora* of Ceylon, and *Psammænas Burnesii* of the Western Deserts (?). Also *Col. malabarica*, Lath. (*Colombe brame* of Temminck), founded on *la Tourterelle de la côte de Malabar* of Sonnerat. Size of *Turtur risorius*; head, back and wing pale ash-gray; the neck and breast weak vinous-gray; belly white; some oval black spots on the greater wing-coverts; tail marked with white as in the other Turtle-doves; bill, irides and feet red. Whether the Indian *Carpophagæ* ever lay more than a single egg in each nest is also a subject for investigation.—E. B.

April 4, 1846.

* This Javanese bird is certainly *T. orientalis* (Lath.) and *gelastis* (Temm.), the former of which names holds precedence for the species.

The Indian bird may safely stand as *Turtur orientalis*. To its synonyms may be added that of *Columba ferrago*, Eversmann, 'Addenda ad Pallasii Zoographiam Rosso-Asiaticam,' Casan, part iii. 1842, p. 17, from which it appears that this species extends northwards as far as Songaria.—H. E. S.

BIBLIOGRAPHICAL NOTICES.

Lectures on the Comparative Anatomy and Physiology of the Vertebrate Animals: Part I. *Fishes,* being Vol. II. of Hunterian Lectures. By Richard Owen, F.R.S. London, Longman and Co., 1846.

Prepared as we had already been from all the former labours of our distinguished author to form high expectations with regard to the present work, we rejoice to find that these have been so richly fulfilled, and that in thus embodying the results of his own investigations and those of others in a definite form, available at once to the student and the matured scientific inquirer, Professor Owen has been at work with the same untiring eye and hand, animated and guided by the same profound and philosophic spirit of analysis when applied to the higher organisms or Vertebrata, as heretofore. As in Vol. I., this, which is devoted exclusively to Fishes, commences as a sequel to the Introductory Lecture with a clear and ample survey of the leading or typical characters by which the Vertebrate animals in general are distinguished from the Invertebrata; allusion is then made to the "amount of concordance which will justify us in predicating unity of organization" between any members of these two great types, and it is shown that to do this we must look to the very beginning of the development of the vertebrated being, in which, "in the mysterious properties of the impregnated germinal vesicle, diffused and distributed by fissiparous multiplication amongst countless nucleated cells, is an organic correspondence to be first traced with the lowest and simplest beginnings of animal life—with the infusorial monads." Attention is next directed to the second stage in the development of the ovum, when with the appearance of the double chord the nascent being is impressed with its vertebrated type; after which follow full descriptions of the several classes of Fishes, Reptiles, Birds and Mammalia, with reference not only to their anatomical, but geological, grade of succession through the various strata of the earth's crust. We pass over the intervening five chapters, designing to reserve their consideration for the last, and are met for the first time in our language with a clear and definite outline at Lecture VII. of the conditions general as well as special displayed by the muscular system of Fishes, although, adds the Professor, "the determination of the special, serial, and general homologies, and the recognition of the various individual adaptive modifications, of the muscles of Fishes, still remains a rich and little-explored field for the labours of the myologist." With the discourse upon the nervous system, as it commences in the Lancelet by a simple continuous chord, more obtuse only at the anterior end, where its homology to the ganglionic brain of the higher species is indicated by connexion with the trigeminal and optic nerves, we have been most especially interested: first and foremost by the adoption of a rational, or the only true kind of scientific nomenclature, for the several parts composing the nervous axis, such, *e.g.* as the terms prosencephalon, mesencephalon and epencephalon, as expressive first of the cerebrum,

secondly of the optic lobes, and thirdly of the medulla oblongata and cerebellum, while the olfactory lobes, as being serially homologous to the optic, have been designated by the apt appellation of rhinencephala; secondly, by the eminently suggestive observations at pp. 187, 190, relative to the functions performed by the different portions of the brain, more especially of the prosencephalon and cerebellum, the last of which, after a careful comparison of its degrees of development as evidenced by the "sluggish Rays" and "vigorous Sharks," our author inclines to believe is very directly subservient to the power of locomotion. How fully were we convinced, upon reading this, of the profound truth of a remark made by Oken in his 'Naturphilosophie,' "that the reason why we have as yet wandered to and fro, without main-stay and without compass, in the pursuit of mental philosophy, rests solely in the disregard that has been paid to the knowledge or science of nature!" Would we essay to decipher the psychical functions and their allotted organs in the human brain, recourse must be had less to experiment than to the study of that organ throughout the Vertebrate series; "since (p. 187) it may well be doubted whether nature ever answers so truly when put to the torture, as she does when speaking voluntarily through her own experiments, if we may so call the ablation and addition of parts which comparative anatomy offers to our contemplation." To follow our author through the rich record of facts and reflective observation contained under the head just alluded to, and including the special organs of sense and electric apparatus, or into the dental and digestive, followed by the vascular, system, a masterly account of the air-bladder in the lecture devoted to the pneumatic and renal organs, or finally into the elaborate description of the generative system and developmental process in the class of Fishes; would be but to multiply quotations and gratify an idle and temporary curiosity on many important points, which, to be fully appreciated, must be read in their proper places along with the context, where each fact and its interpretation form but the linked parts of one great Whole. We hasten therefore at once to indulge in a few words concerning that which has been omitted hitherto, expressly that it might be last mentioned, seeing that it constitutes a large portion of the present volume, and from the objects whereof it treats, and the manner in which that is effected, deservedly forms the most valuable and novel feature, paramount to every other perfection in this goodly contribution to British science, while it lays claim to presaging a new dawn or mental epoch in the career of biological investigation. We allude to that which is the principal subject-matter of Lectures II. to VI. inclusive, where, in considering the skeleton, vertebræ and vertebral column, the skull, with finally the dermal bones, in the different Piscine orders, our author enters learnedly and largely into the determination of the homologies or structural relations of the several parts of the skeleton in Fish, when contrasted in the different members of that class or those belonging to the other great divisions of the Vertebrate series But let us preface in our author's own words the definition and scope of the term *homology* as applied in the present, and to be

strictly regarded in such a sense throughout his forthcoming, labours among the remaining classes of Vertebrata. "The great aim of the philosophical osteologist is to determine by natural characters, the natural groups of bones of which a vertebrate skeleton typically consists; and next, the relations of individual simple bones to each other in those primary groups, and to define the general serial and special homologies of each bone throughout the Vertebrate series. By general homology I mean the relation in which a bone stands to the primary segment of the skeleton of which it is a part; thus, when the basi-occipital bone (basilar process of the os occipitis in anthropotomy) is said to be the centrum or body of the occipital or posterior cranial vertebra, its *general* homology is enunciated. When it is said to repeat in its vertebra, or to answer to the basi-sphenoid in the parietal vertebra, or to the body or centrum in the atlas, dentata, or any other of the vertebral segments of the skeleton, its *serial* homology is indicated; when the essential correspondence of the basilar process of the occipital bone in Man with the distinct bone called 'basi-occipital' in a Crocodile or Fish is shown, its *special* homology is determined." With the above clear and exact formula of the object and the course to be pursued in its attainment, we must pause, for the space allotted in this Journal will not admit of our entering into detail; and, as a sufficient plea for our silence, will simply remind the reader of what has been observed by Oken, to whom is unquestionably due the honour of having first announced in an essay, published in 1807, and entitled 'Ueber die Bedeutung der Schädelknochen,' the relations of identity existing between the cranial bones and the other segments of the vertebral column: "It is *bonâ fide*," says he, "remarkable what it costs in order to bring but *one* problem of philosophical anatomy into a pure state, or that of solution. He who has not been engaged in such a task remains without conception of its difficulties. Without knowing the what, how and why, one may stand not for hours nor days, but weeks, before a Fish's skull, and vacantly stare at its calcareo-stalactitic forms." Now, in the work of Prof. Owen, the diligent reader alone will be in a capacity to appreciate the force of the above quotation; when, after having worked his way, and this from the striking precision of our author's language, he will effect with pleasure instead of toil to himself, and, if resident in London, availed himself of the opportunity of comparing and testing the text by skeletons of fish now mounted and labelled with appropriate catalogues of the homological terms in the College of Surgeons' Museum, he next turns to the table of synonyms of the bones of the head of Fishes, according to their special homologies, at pp. 158—162, and in the contrast of our countryman's nomenclature with those of prior zootomists, such as the great Cuvier, Geoffroy, Bojanus, Spix, Meckel, Carus, and others, there discerns the great and priceless boon that has been conferred upon subsequent inquirers by this unravelling of a false, because in many respects unmeaning and artificial terminology, and the substitution in its place by the Professor of scientific words intelligible from their appositely compound or connotative character,

as *e. g.* basio-occipital for the basilaire, and meso-, pre- and hypo-tympanic instead of the symplectique, tympanal and jugal bones of Cuvier. Again, we repeat, a new epoch dawns upon the science of Comparative Anatomy. For, should the views of Prof. Owen, when critically analysed, receive the general assent of British and continental observers, it is not going too far to predict the important influence they must inevitably exercise in simplifying the acquirement by the student, not only of the osseous system of animals, but of Man; their conducing to a gradual recognition and accordant naming of the primary ganglionic portions of the brain in harmony with its corresponding skeletal segments, and finally, carried yet further and associated with other generalizations, laying the logical groundwork of a natural classification of the animal kingdom. In fine, to Prof. Owen, in his investigation of homological relations, is due the rare merit of having been the first to grapple with, and carry into amplitude of detail, a principle, which though only partially evolved, was boldly announced as if irrefragable, by Oken; while rejected by Agassiz and discussed or enlarged upon by other writers, the question has at length devolved to the cautious and inductive reasoning of the worthy successor of John Hunter, for ultimate extrication from its labyrinth, and thus implantation upon a true philosophic basis. Before such a statement of plain historical fact, the usually knotty points touching priority of discovery must dissolve in the mind of the candid and liberal reader, who, revering Truth for her sake alone, will rest content with adjudging the crown of honour to him who has struggled best in behalf of her cause.

PROCEEDINGS OF LEARNED SOCIETIES.

LINNÆAN SOCIETY.

May 24, 1846.—The Lord Bishop of Norwich, President, in the Chair.

This day, the Anniversary of the birth of Linnæus, and that appointed by the Charter for the election of Council and Officers, the President opened the business of the Meeting and stated the number of Members whom the Society had lost during the past year, of some of whom the Secretary read the following notices:—

James Hussey Abraham, Esq., for nearly half a century the conductor of the most flourishing seminary in the town of Sheffield, was well-skilled in various branches of Natural Philosophy, especially Electricity and Magnetism, and possessed a large and valuable collection of apparatus with which he illustrated his lectures on these and allied branches of science. In the course of his magnetic experiments, the idea suggested itself to him that the minute particles of steel evolved in the dry grinding of forks, needles, &c., the inhalation of which is so deleterious to the workmen engaged in those trades, might be intercepted by means of a wire-gauze mask, or caught by a chaplet of magnets worn about the mouth of the ope-

rator. For the ingenious contrivance by which he proposed to effect this object, he received in 1821 the large gold medal of the Society of Arts. Other ingenious modifications of the practical application of the magnet were also devised by Mr. Abraham; and he delivered a lecture on this, his favourite topic, at an evening meeting of the British Association, at their first meeting in the city of York in 1831. In conjunction with his friend James Montgomery the poet, who then edited one of the local newspapers, he was mainly instrumental in originating the Literary and Philosophical Society of Sheffield, of which in 1834 he was elected President. He was also celebrated in his neighbourhood for his skill in horticulture, and seldom failed to carry off one or more prizes at the exhibitions of the Sheffield Horticultural Society, founded in 1830 by himself and some friends; the prize medals of which Society bear on their obverse an exquisitely engraved head of Linnæus. Mr. Abraham died on the 5th of February in the present year, in the 69th year of his age. He became a Fellow of the Linnean Society in 1825.

Henry Singer Chinnock, Esq.

Barron Field, Esq., was born on the 23rd of October 1786. He was the second son of Mr. Henry Field, who was in extensive medical practice in London, and for many years apothecary to Christ's Hospital. Mr. Barron Field was lineally descended in the sixth degree from Oliver Cromwell; his grandfather, Mr. John Field, having married Anne, the daughter of Thomas Cromwell, who was grandson of Henry Cromwell, Lord Deputy of Ireland, the younger son of the Protector. Mr. Barron Field was educated for the profession of the law, and called to the bar by the Honourable Society of the Inner Temple. In 1811 he published an 'Analysis of Blackstone's Commentaries,' which has become a standard work for the use and instruction of students. In 1816 he was appointed Judge of the Supreme Court of New South Wales, and continued to exercise the duties of that office till 1824; when, on a change in the Charter of Justice for that colony, he relinquished his appointment and returned to England. Early in 1829 he received from Government the appointment of Chief Justice of Gibraltar, which he held until ill-health obliged him to retire and return to his native country. In both these distant appointments Mr. Barron Field applied himself to what was always with him a favourite relaxation, the study of botany. In New South Wales he availed himself of the talents of Mr. Lewin, the distinguished painter of natural history, and formed a pleasing collection of drawings of Botany Bay plants; and his garden at Gibraltar, situate at nearly the most southern point of Europe, exhibited fine specimens of geraniums, cacti and other beautiful plants, flourishing in an almost natural state. Mr. Barron Field also dedicated much of his leisure to the critical perusal of the early English dramatists and poets; and latterly attached himself to the Shakspeare Society, of which he was chosen one of the Council, and for which he edited several old dramas. He died on the 11th of April 1846, in his 60th year, at Torquay in South Devon, where he had resided for the last two years.

During his residence in New South Wales he published a small volume of poems, the first that had ever been printed in that colony, which he subsequently included in a collection of 'Memoirs on New South Wales,' containing, among several geographical papers of interest, some notes by Allan Cunningham on the Botany of New Holland. He became a Fellow of the Linnean Society in 1825.

The Rev. Thomas Gisborne, Prebendary of Durham, a name distinguished in the literature of our country, was attached from early life to the pursuit of natural history, to which his 'Rural Walks,' first published in 1795, bear in many passages ample testimony. It is not necessary to speak here, and indeed it would be out of place to do so, of the value of his ethical and religious writings; but he well deserves mention as one of the most zealous collectors of rare British birds, and for his great liberality to the Durham Museum, of which he was one of the founders and principal patrons. The fine collection of British birds, which forms the foundation of that Museum, was munificently purchased and presented to the Institution by him, and he never missed an opportunity of adding to its value and completeness by supplying its deficiencies in the rarer species. He became a Fellow of the Linnean Society in the year 1799, and died in the spring of the present year.

Robert Graham, M.D., Regius Professor of Botany in the University of Edinburgh, was the third son of Dr. Robert Graham, and was born at Stirling on the 7th of December 1786. In the first part of his career he practised medicine in Glasgow, and in 1818 he was appointed to the Professorship of Botany then first established by the Crown as a distinct chair in the University of that city. In 1820 he was transferred to the Botanical chair of the University of Edinburgh, which he filled up to the time of his death. In the same year he became a Fellow of the Royal Society of Edinburgh, and in 1821 of the Linnean Society.

Dr. Graham devoted himself assiduously and successfully to the duties of his office. By his energy and enthusiasm, as well as by his affable and pleasing manners, he succeeded in implanting a taste for his favourite science among the pupils of his class, many of whom have since become able teachers, as well as zealous students and collectors. In the promotion of this taste he derived much assistance from the botanical excursions which he made in company with his pupils, not merely in the neighbourhood of Edinburgh, but in distant parts of Scotland, and even in England and in Ireland, in the course of which several additions were made to the Scottish flora. During these excursions he also laid in a large store of materials for a Flora of Britain, in the preparation of which he had been long engaged, but which he did not live to complete. His published works consist chiefly of descriptions of new or rare plants from the Edinburgh Botanic Garden, which owes much of its present excellence to his exertions. These descriptions, together with notices of his botanical excursions, appeared in the 'Edinburgh New Philosophical Journal' and in the 'Botanical Magazine.' In the 'Companion' to the latter work, published by Sir Wm. J. Hooker, he also gave "an account

of the Camboge-tree of Ceylon." His favourite tribe was the *Leguminosæ*, and he had undertaken to describe the plants of that extensive family contained in Dr. Wallich's Indian herbarium, but subsequently relinquished the intention and transferred the plants to Mr. Bentham, who has made considerable progress in their illustration.

The genus *Grahamia* jointly commemorates the botanical merits of Mrs. Graham, afterwards Lady Callcott, and those of Dr. Graham; and several species have also been named in honour of the latter. He died on the 7th of August last at the house of his brother at Coldoch in Perthshire, after a long and painful illness, leaving behind him the character of an able and enthusiastic teacher, a warm and zealous friend, and a candid and honourable man.

In *Joseph Janson, Esq.*, the Society has lost a very active and zealous member. He was born at Tottenham in Middlesex on the 12th of July 1789, and became a Fellow of the Linnæan Society in November 1831. Before his election into the Society, he contributed towards the purchase of the Linnæan collections, and it was owing in a great degree to his exertions that the subscription was set on foot which has enabled us to pay off so large a portion of our debt. The Society has since been indebted to Mr. Janson for a valuable set of cabinets for its herbarium, and for the cabinet which contains the principal part of the collection of fruits which have been so carefully arranged by Mr. Kippist. To the library also he has presented upwards of forty volumes of local European floras; and he was always ready to add to our collections, or to aid in giving interest to our meetings by the exhibition of rare and curious specimens from his garden at Stoke Newington, where, in addition to the more usual garden plants, he was particularly successful in the cultivation of the rarer and less determinately settled British species.

Mr. Janson was, as many now present can well bear testimony, a man of cultivated understanding, of a clear head and a warm heart. He was ever ready to perceive and to acknowledge merit, and it was one of his benevolent pleasures to bring forward young men of talent and to put them in a way of making their abilities available. He was a zealous friend of various establishments for the education of the poor, to the promotion of the objects of which he devoted much time and labour as well as rendering pecuniary assistance. He was never married. He died on the 30th of April in the present year after a long illness, which did not assume a dangerous appearance until about a fortnight before his death. By his will he has bequeathed to the Society a legacy of 100*l*.

Henry Gally Knight, Esq., M.P., distinguished for his extensive acquaintance with the architecture of the middle ages, on which he published several highly beautiful and important works. He was educated at Eton and afterwards at Trinity College, Cambridge, where he formed an acquaintance with Byron, which he renewed during a tour in the East in 1810–11, and which probably led to his attempting poetry in a series of new 'Persian Tales.' These, however, met with little success, and he devoted himself during the latter years of his life to the more congenial study of mediæval

architecture. He was returned to parliament in 1834 for North Nottinghamshire, for which he continued to sit till the time of his death, which occurred on the 9th of February in the present year, and in the 59th year of his age. He became a Fellow of the Linnæan Society in 1818.

Richard Latham, Esq., received the rudiments of his education at Christ's Hospital, and in grateful recollection of the benefit, devoted the first four hundred pounds which he saved by industry and frugality to the uses of that noble institution. He became connected with the extensive brewery of Sir Henry Meux and Co., of which for more than a quarter of a century he was acting partner. In this position he acquired considerable wealth; while he amused his leisure hours with the pursuits of chemistry, geology, botany and ornithology. He also contributed largely to the funds of many of the most important charitable institutions of the metropolis. He became a Fellow of the Linnæan Society in 1821, and died at his residence at Bayswater on the 24th of January in the present year, and in the 79th year of his age.

Thomas Knowlton, Esq., the son of a father of the same names, who was in the early part of his life gardener to Sherard, and afterwards to the Earl of Burlington, and who is mentioned with honour in Pulteney's 'Sketches of the Progress of Botany in England' as an antiquary as well as a naturalist. Our deceased member inherited his father's taste for natural history, and formed a valuable botanical and zoological library, which was disposed of by auction on the death of its proprietor in the spring of the present year. The elder Knowlton died in 1784 at the advanced age of 90, and his son, who became a Fellow of the Linnæan Society in 1795, must also have reached a good old age.

Charles Lush, Esq., M.D., was educated as a surgeon, and the first bent of his mind towards natural history was given in a small society of juniors to which several of our Fellows who have since distinguished themselves also belonged. He became the Botanical Lecturer at St. Thomas's Hospital in 1825, and in 1827 sailed for India as an Assistant-Surgeon in the East India Company's service on the Bombay establishment. Soon after his arrival he was appointed to take charge of the Botanic Garden at Dapooree near Poona, which appointment he retained until his return to England in 1837. In 1829 he was employed by the Bombay Government in travelling in the Southern Mahratta country, along the coast of Canara, and visiting the Portuguese settlement of Goa, &c. in order to select a suitable spot for the establishment of an experimental cotton-farm. His report of the results of this journey was published with the approbation of the authorities, and circulated among all the magistrates and other functionaries. From 1830 to 1833 he had the direction of some experiments in the cultivation of silk and cotton carried on in the Southern Provinces, and in 1833 made a report to the Government respecting mulberries for the feeding of the silk-worms. In 1836 he visited the cotton districts in Guzerat, for the purpose of inspecting the different farms, on the subject of which he furnished

a report; and in the same year he communicated to the Medical and Physical Society of Bombay, a paper published in December in the 'Journal of the Asiatic Society of Bengal,' entitled "Geological Notes on the Northern Conkan, and a small portion of Guzerat and Kattywàr." In this paper he mentions the discovery by himself in the Island of Perim, in the Gulf of Cambay, of a large deposit of fossil bones, which has since been more fully investigated by Capt. Fulljames and Dr. Falconer, and has been found to comprise some of the most remarkable among the very extraordinary fossils for the knowledge of which we have recently been indebted to the naturalists of India.

In 1837 he returned to England overland, and in 1840 again proceeded to India, where he was appointed surgeon to the 14th Bombay Native Infantry, and accompanied that regiment in 1844 to Kurrachee in Scinde, and in 1845 to Hydrabad, where he fell a victim to spasmodic cholera on the 4th of July, in the 49th or 50th year of his age.

In character Dr. Lush was well-known to many of our members as warm-hearted, sincere, and of so sweet a disposition, that I am assured by one of our Fellows who knew him best, that during a close intimacy of many years he never saw him out of temper. He was a constant peacemaker, and his simplicity was extraordinary. His talents were excellent, and had his application been equal, there is no doubt that he would have attained a high position in science.

Peter Nouaille, Esq.

Of our *Associates* we have lost two during the past year.

Mr. James Main began life as a working gardener in the neighbourhood of Edinburgh, and was afterwards employed by Mr. George Hibbert, to whom we are indebted for the introduction of many valuable plants through the means of collectors whom he sent abroad. One of these was Mr. Main, whom he despatched to China, and who continued in Mr. Hibbert's employ for some years after his return to England, but afterwards took a farm in Scotland. Here he was unsuccessful; but having made himself well-acquainted with the received theories and practice both of horticulture and of agriculture, he turned his attention to the literature of those subjects, and from this time forwards became a frequent and welcome contributor to some of the principal periodicals devoted to their illustration. In the year 1830 he published 'The Villa and Cottage Florist's Directory,' which reached a second edition in 1835; in 1833 'Illustrations of Vegetable Physiology, practically applied;' in 1835 'Popular Botany;' and in 1839 'The Young Farmer's Manual,' and 'The Forest Planter's and Pruner's Assistant;' and he also edited new editions of Mawe's 'Every Man his own Gardener,' and of several other works of a similar character.

Mr. Main was elected an Associate of the Linnæan Society in 1829, and communicated to us in 1844 a paper entitled "Remarks on Vegetable Physiology," in which he reproduced the leading ideas on the growth of plants contained in his 'Illustrations of Vegetable Physiology.' Of this paper an abstract is published in the 'Proceed-

ings' of the Society. He died at Chelsea in the spring of the present year at an advanced age.

Mr. George Samouelle was brought up to the business of a bookseller, and was for several years an assistant in the establishment of Messrs. Longman and Co. He early imbibed a taste for natural history, and more especially for entomology, and became an assiduous collector of British insects. In 1819 he published a work entitled 'The Entomologist's Useful Compendium, or an Introduction to the Knowledge of British Insects, comprising the best means of obtaining and preserving them, and a description of the Apparatus generally used; together with the genera of Linné, and the modern method of arranging the Classes *Crustacea, Myriapoda, Spiders, Mites* and *Insects*, from their affinities and structure, according to the views of Dr. Leach. Also, an explanation of the terms used in Entomology; a Calendar of the times of appearance and usual situations of near 3000 species of British Insects; with instructions for collecting and fitting up objects for the Microscope. Illustrated with twelve plates,' 8vo, Lond. In this work, the multifarious nature of which may be inferred from the title-page, Mr. Samouelle furnished the British entomologist with a careful and valuable compilation, and added moreover numerous original observations calculated to be useful to the collector; but the greater part of the work, as well as the most important in a scientific point of view, was derived from the MSS. of Dr. Leach, which were freely communicated to the author. This work was followed by 'General Directions for collecting and preserving Exotic Insects and Crustacea,' 18mo, Lond., 1826. Soon after the publication of his 'Compendium' Mr. Samouelle became an assistant in the Natural History Department of the British Museum, and was chiefly employed for many years in the care and arrangement of the entomological collections of that establishment. In 1832 he commenced the publication of an illustrated periodical, entitled 'The Entomological Cabinet; being a Natural History of British Insects,' of which he completed two annual volumes. He afterwards issued two numbers of a second series of the same work, but not meeting with sufficient encouragement he proceeded no farther. In 1836 he also published two numbers of a second edition of his 'Entomologist's Useful Compendium,' but this undertaking fell to the ground from the same cause. He was elected an Associate of the Linnæan Society in 1818, and died at Lambeth in the spring of the present year.

His principal work was highly useful at the time of its appearance, following as it did on the two introductory volumes of Messrs. Kirby and Spence, and affording to the numerous students who were incited by those volumes to take up entomological pursuits, a manual of information for their guidance in collecting, preserving and arranging insects, which was then greatly wanted by British entomologists.

At the election, which subsequently took place, the Lord Bishop of Norwich was re-elected President; Edward Forster, Esq., Treasurer; John Joseph Bennett, Esq., Secretary; and Richard Taylor,

Esq., Under-Secretary. The following five Fellows were elected into the Council in the room of others going out: viz. Sir Henry Thomas De la Beche; Hugh Falconer, M.D.; Joseph Dalton Hooker, M.D.; William Wilson Saunders, Esq., and William Yarrell, Esq.

June 2.—E. Forster, Esq., V.P., in the Chair.

Read some "Notes towards a Statistical Account of the Fauna of New Zealand and the Auckland Islands, so far as regards Annulose Animals." By Adam White, Esq., M.E.S., Assistant in the Zoological Department of the British Museum. Communicated by the Secretary.

In these notes, Mr. White remarks on the advantages offered by an insular position, of comparatively limited extent and far removed from any great continent, in the drawing up a local fauna or flora; and anticipates that in the course of time, when we shall have been furnished with nearly perfect lists of the animals and vegetables inhabiting New Zealand, we may arrive at tangible results regarding them, free from the disturbing influences which result from the great extent and varied nature of such a continent as New Holland, and from the ready access afforded to wanderers of both kingdoms by the proximity of such islands as our own to great and almost adjoining continents. He limits his present observations to the Coleopterous order of insects, and states the sources from which the various collections examined by him have been derived. From the information which he has been enabled to acquire from all these sources he arrives at the following conclusions:—1st, that *Coleoptera* do not abound in species in New Zealand; 2ndly, that the numbers of *Cicindelidæ*, *Carabidæ*, *Curculionidæ* and *Longicornes* are strikingly characteristic of its Coleopterous fauna as compared with any part of New Holland; and 3rdly, that *Cetoniadæ*, *Buprestidæ* and *Chrysomelidæ*, so abundant in nearly every part of the Australian continent, are either wanting or very poorly represented in New Zealand. He does not, however, venture in the present state of our knowledge to propound these as axioms; and instances the paucity of species of various orders of insects, especially *Hymenoptera* and *Neuroptera*, enumerated in the 'Fauna Boreali-Americana,' as compared with the large number of species of those orders collected by Mr. Barnston in a single locality within the limits of that territory, as a striking example of the fallacy of the conclusions which might be drawn from insufficient and uncertain data.

The author then proceeds to give an enumeration of the species of each Coleopterous family hitherto detected in New Zealand; and observes in a note that the *Æshna liassina* of Strickland, a Neuropterous insect, of which a lower wing has been found in the lias of Stonesfield, belongs (as Mr. Dale has conjectured) to a genus closely allied to *Petalura*, which latter has hitherto only been detected living in New Zealand and New Holland.

June 16.—The Lord Bishop of Norwich, President, in the Chair.

Read a paper "On the calcifying functions of the Cowry and the

Olive, two genera of Pectinibranchiate Mollusks." By Lovell Reeve, Esq., A.L.S. &c. &c.

After referring to the numerous instances of very considerable modifications in the form of shell and mode of calcification which occur among *Mollusca*, even in genera very nearly related to each other, Mr. Reeve proceeds to describe more particularly the manner in which the calcifying process is performed in the two genera which form the subject of his paper. Each of these genera produces a porcellanous shell of very analogous structure, consisting of a cylinder of several enlarging whorls, convoluted on a plane nearly vertical to the spire, and composed of layers of vitrified enamel of different colours and design; but there is a striking difference in the calcifying organ as regards its structure and its function of secretion. In the Cowry the office of calcification is performed by a lobate expansion of the mantle from either side of the aperture, sufficiently large to cover the entire shell, and retracted only under the influence of alarm. In the Olive, on the other hand, the mantle is limited to the interior and the aperture of the shell; and appears to be furled over the edge of the lip, and retained in a state of tension by a cord or filament passing from its posterior extremity into a narrow channel which is excavated round the spire of the shell in place of the suture. The result of this difference in the condition of the calcifying organ is, that in the Cowry the testaceous secretion is deposited over the whole shell from the outside in successive layers at different intervals of time, while in the Olive the layers must be secreted simultaneously at the lip alone, and the porcellanous surface of the shell is preserved (both in its course of retrovolution and after maturity) by a reflection of the ventral disc somewhat analogous to the reflected mantle of the Cowry, but bearing no part in the formation of the shell.

In support of this view and with the view of proving that this distinction is borne out by the physical condition of the shells at different periods of growth, the author takes for examples *Cypræa Tigris* and *Oliva Utriculus*. The Tiger Cowry in its first stage is of a uniform light chestnut-bay; the colour then breaks up, as it were, into bands of close-set blotches of a richer hue; a coating of white is next superposed, and upon that is deposited a series of rather distant zigzag flames; these are partially concealed by a second layer of white enamel thinner and more delicate than the preceding one, on which a number of dark spots are subsequently deposited; and a third coating of white enamel, with a new layer of black and brown spots intermingled, characterizes the maturity of the shell. Each period in the life of the Cowry appears therefore to be distinguished by a different design of colouring; but this is not the case with the Olive, the shell of which exhibits the same appearance at all stages of its growth, and the different layers of its colouring matter must be deposited simultaneously because the organ of calcification extends only to the lip, from which the shell gradually recedes in the progress of its growth. The external coating of *Oliva Utriculus* is of an obscure milky-blue, and the removal of this layer by means

of an acid reveals a dull ashy ground sprinkled with numerous triangular opal-like dashes; in *Oliva Brasiliensis* the removal of the outer layer exhibits a longitudinally striped pattern, and other varieties of design may be found in different species; but there is no periodical change of colour in the entire shell to mark its advancement in growth.

November 3.—R. Brown, Esq., V.P., in the Chair.

Read a "Description of the Asafœtida plant of Central Asia." By Hugh Falconer, Esq., M.D., F.L.S. &c. &c.

Dr. Falconer describes the plant which yields the Asafœtida under the following characters :—

Ord. UMBELLIFERÆ.

Trib. PEUCEDANEÆ.

Gen. NARTHEX, *Falc.*

Calycis margo obsoletus. *Petala* ? *Stylopodium* plicato-urceolatum. *Styli* filiformes demùm reflexi. *Fructus* a dorso plano-compressus, margine dilatato cinctus. *Mericarpia* jugis primariis 5, 3 intermediis filiformibus, 2 lateralibus obsoletioribus margini contiguis immersis. *Vittæ* in valleculis dorsalibus plerumque solitariæ (valleculis lateralibus nunc sesqui- vel bi-vittatis); commissurales 4—6 variæ inæquales, exterioribus sæpè reticulatim interruptis. *Semen* complanatum. *Carpophorum* bipartitum. *Umbellæ* pedunculatæ, compositæ. *Involucrum* utrumque nullum.—*Genus inter* Peucedaneas *calycis margine edentato; fructûs vittis magnis, commissuralibus inæqualibus; involucroque utroque nullo distinctum.* Narthex *nuncupatum a vocabulo* νάρθηξ, *apud Dioscoridem* Ferulæ *attributo.*

N. ASAFŒTIDA, caule tereti simplici petiolis dilatatis aphyllis instructo, foliis radicalibus fasciculatis; petiolis trisectis; segmentis bipinnatisectis: laciniis lineari-lanceolatis obtusis inæquilateralibus integris vel variè sinuatis decurrentibus.

Asafœtida Disguuensis, *Kæmpf. Amœn. Exot.* p. 535.

Ferula Asafœtida, *Linn. Mat. Med.* p. 79; *Dec. Prodr.* iv. 173; *Lindl. Fl. Med.* p. 45.

Hab. in apricis inter saxa in valle "Astore" vel "Hussorah" dictâ prope Indum ultra Cashmeer; indigenis Daradris "Sip" vel "Sŭp" dictum. Legi fructigerum prope Boosthōn die 21mo Septembris 1838.

Dr. Falconer states that he has compared his materials with Kæmpfer's description and figures and with the original specimens of that author in the collection of the British Museum, and found them to agree, so far as a comparison could be instituted, in every essential particular. Jubbar Khan, the Dardoh Rajah of the country in which Dr. Falconer gathered his specimens, at once recognised the plant as that which furnishes the *Heeng* or Asafœtida of commerce, and referred to the medicinal accounts given of it by the Persian and Arabic authors; but the Dardohs are a wild race and do not collect the gum-resin for exportation. Some young roots were carefully removed and introduced in the first instance into the Botanic Garden at Saharunpoor, but afterwards transferred to the subsidiary hill garden at Mussooree. Of these some had succeeded

well, but had not flowered up to the time of Dr. Falconer's leaving India; and one of these furnished the leaves which were represented in a figure accompanying the paper, together with a small quantity of Asafœtida, differing in no respect from the ordinary condition of that substance as it occurs in commerce. The species is found, as it would appear, in the greatest abundance in the Persian provinces of Khorassan and Laar; and thence extends on the one hand into the plains of Turkestan upon the Oxus, where it seems to have been met with by Sir Alexander Burnes, and on the other stretches across from Beloochistan, through Candahar and other provinces of Affghanistan, to the eastern side of the valley of the Indus in Astore. Dr. Falconer has not met with it in Cashmeer.

Besides the gum-resin, the fruits of the *Narthex Asafœtida* are also imported into India for medicinal use, and along with them the fruits of another umbelliferous plant which Dr. Falconer found to belong to a true *Ferula*, and which are sold under the name of *Doogoo*; a word evidently connected with the Greek *δαῦκος*. Of these fruits he gives a description; and he also mentions another umbelliferous fruit in the collection of Dr. Royle, labelled as "the seed of the Wild Asafœtida plant, collected and brought to England by Sir John MacNeill from Persia," which differs widely from the fruit both of *Narthex* and *Ferula*, and belongs to another tribe of the Order.

November 17.—E. Forster, Esq., V.P., in the Chair.

Read a portion of Dr. William Buchanan Hamilton's "Commentary on the Hortus Malabaricus of Van Rheede."

December 1.—E. Forster, Esq., V.P., in the Chair.

Read a paper "On the Structure and Movements of *Bacillaria paradoxa*, Gmelin." By G. H. K. Thwaites, Esq. Communicated by William Spence, Esq., F.R.S., F.L.S. &c.

Mr. Thwaites commences his memoir by a description of the species. The filaments are ribbon-shaped, curved, pale brown with a paler mesial line, and consist each of from 4 or 5 to upwards of 100 linear frustules, lying contiguous and parallel to each other. The front view of each frustule exhibits a slight tapering towards the apices, and a minute dentation on the inner edge of the smooth raised lateral margins, the intermediate space being smooth. In a side view, the surface of mutual contact is seen to be linear-lanceolate with the apices rounded; and the space between the smooth raised lateral margins is marked with transverse raised striæ. The length of the frustule, and consequently the width of the filament, varies from $\frac{1}{400}$ to $\frac{1}{140}$ of an inch; and the width of the frustule from $\frac{1}{10000}$ to $\frac{1}{3000}$ of an inch. The frustules are filled (with the exception of a lighter transverse central fascia) with a pale brown endochrome; and the filaments increase in length from multiplication of the frustules by fissiparous division.

Mr. Thwaites has found this (the original) species of *Bacillaria* abundantly in ditches at the mouth of the Avon near Bristol, in water

probably slightly blackish, and also in small quantity in the river Frome at Stapleton, encrusting various aquatic plants with a dark brown coating, which under the microscope is resolved into a number of pale brown filaments that seem to adhere tolerably firmly to the plant on which they are situated. When they have been for a few moments detached, a remarkable motion is seen to commence in them. The first indication of this consists in a slight movement of a terminal frustule, which begins to slide lengthwise over its contiguous frustule, the second acts simultaneously in a similar manner with regard to the third, and so on throughout the whole filament; the same action having been going on at the same time at both ends of the filament, but in opposite directions. The central frustule thus appears to remain stationary or nearly so; while each of the others has moved with a rapidity increasing with its distance from the centre, its own rate of movement having been increased by the addition of that of the independent movement of each frustule between it and the central one. This lateral elongation of the filament continues until the point of contact between the contiguous frustules is reduced to a very small portion of their length, when the filament is again contracted by the frustules sliding back again as it were over each other; and this changed direction of movement proceeding, the filament is again drawn out until the frustules are again only slightly in contact. The direction of the movement is then again reversed, and continues to alternate in opposite directions, the time occupied in passing from the elongation in one direction to the opposite being generally about 45 seconds. In the course of this movement the filaments seldom resume their original *Fragilaria*-like appearance; and there are occasional interruptions to its regularity, both the terminal frustules in some cases moving in one and the same direction instead of in a direction opposite to each other. This Mr. Thwaites regards as resulting from a breach in the vital or dynamical connexion of the filament, and as not improbably indicating the place where spontaneous division of the filament is about to occur. If a filament, while in motion, be forcibly divided, the uninjured frustules of each portion continue to move as before, proving (as the author believes) that the filament is a compound structure, notwithstanding that its frustules move in unison. When the filament is elongated to its utmost extent, it is still extremely rigid and requires some comparatively considerable force to bend it, the whole filament moving out of the way of any obstacle rather than bending or separating at the joints. A higher temperature increases the rapidity of the movement.

The author hazards a conjecture that the action of cilia is the proximate cause of the phænomenon; for, although he has been unable to discover cilia, he has little doubt of their presence from the mode in which minute particles of indigo suspended in the water were acted upon, when coming into contact with the frustules. He regards the movement of each individual frustule, considered alone, as closely resembling that which is seen in the detached frustules of other species of *Diatomaceæ*; namely, a so to speak alternate back-

ward and forward movement at regular intervals. On the animal or vegetable nature of the production he has no remarks to offer.

The paper was accompanied by magnified drawings of *Bacillaria paradoxa* in various stages of elongation and retraction; and by very highly magnified representations of its mode of fissiparous increase, and of the markings on both its surfaces.

Read also the commencement of a memoir "On the Vegetation of the Galapagos Archipelago, as compared with that of some other Tropical Islands and of the Continent of America." By Joseph Dalton Hooker, Esq., M.D., F.L.S. &c.

ROYAL INSTITUTION.

Jan. 29, 1847.—"On the fundamental type and homologies of the Vertebrate Skeleton." By Prof. Owen.

The Professor commenced by alluding to the origin of anatomy in the investigation of the human structure, in relation to the relief and cure of disease and injuries; and to the consequent creation of an anatomical nomenclature, having reference solely to the forms, proportions, likenesses and supposed functions of the parts of the human body; which were originally studied from an insulated point of view, and irrespective of any other animal structure or any common type. So, likewise, the veterinary surgeon had begun the study of the anatomy of the horse in an equally independent manner, and had given as arbitrary names to the parts which he observed. Thus, in the head of a horse there was the "os quadratum;" and in the foot the "cannon-bone," the "great" and "small pastern-bones," the "coronet," and "coffin-bones," &c. When the naturalist first sought to penetrate beneath the superficial characters of the objects of his study, their anatomy had often been conducted in the same insulated and irrelative way. The ornithotomist, or dissector of birds, described his "ossa homoidea," "ossa communicantia" seu "interarticularia," his "columella," his "os furcatorium" and "os quadratum," the latter being quite a distinct bone from the "os quadratum" of the hippotomist. The anatomiser of reptiles described "hatchet-bones" and "chevron-bones," an "os cinguliforme" or "os en ceinture," and an "os transversum;" he had also his "columella," but which was a bone distinct from that so called in the bird. The ichthyotomist described the "os discoideum," "os transversum," "os cœnosteon," "os mystaceum," "ossa symplectica," "prima," "secunda," "tertia," "quarta," &c. Each at first viewed his subject independently and irrelatively; and finding, therefore, apparently new organs, created a new and arbitrary nomenclature for them.

After pointing out the impediments to a philosophical knowledge of anatomy, from such disconnected attempts to master its complexities, and the almost impossibility of retaining in the memory such an enormous load of names, many distinct ones signifying the same essential part, whilst different parts had received the same name, Prof. Owen proceeded to demonstrate the principal results of the philoso-

phical researches of Cuvier, and other comparative anatomists, in tracing the same or homologous parts through the animal series, as they were exemplified in the osseous system, and principally in the bones of the head. When any bone in the human skull, for example, had been thus traced and determined in the skulls of the lower vertebrate animals, the same name was applied to it there as it bore in human anatomy, but understood in an arbitrary sense; and when the part had no name in human anatomy, but was indicated, as often happened, by a descriptive phrase, it received a name having a close relation to such phrase; and thus a uniform nomenclature had arisen out of the investigation of the homologies of the bones of the skeleton, applicable alike to the human subject, the quadruped, the bird, and the fish. The corresponding parts have been sometimes called *analogues*, and sometimes *homologues*; the latter being the appropriate term, since the parts are in fact namesakes. The essential difference between the relations of *analogy* and *homology* was illustrated by reference to a diagram of the skeletons of the ancient and modern flying dragons. The wings of the extinct pterodactyle were sustained by a modification of the bones of the fore-arm or pectoral limb, which bones were long and slender, like those of the bat; and one of the fingers, answering to our little finger, was enormously elongated. The wings of the little *Draco volans*, the species which now flits about the trees of the Indian tropics, were supported by its ribs, which were liberated from an attachment to a sternum, and were much elongated and attenuated for that purpose. The wing of the pterodactyle was *analogous* to the wing of the Draco, inasmuch as it had a similar relation of subserviency to flight; but it was not *homologous* with it, inasmuch as it was composed of distinct parts. The true homologue of the wing of the pterodactyle was the fore-leg of the little *Draco volans*.

The recognition of the same part in different species, Prof. Owen called the "determination of its special homology;" the recognition of its relation to a primary segment of the typical skeleton of the vertebrata, he called the "determination of its general homology." Before entering upon the higher generalization involved in the consideration of the common or fundamental type, Prof. Owen gave many illustrations of the extent to which the determination of special homologies had been carried, dwelling upon those which explained the nature and signification of the separate points of ossification at which some of the single cranial bones in anthropotomy began to be formed; as in the so-called "occipital," "sphenoid," and "temporal" bones. More than ninety per cent. of the bones in the human skeleton had had their namesakes or homologues recognized by common consent in the skeletons of all vertebrate animals; and Prof. Owen believed the differences of opinion on the small residuum capable, with one or two exceptions, of satisfactory adjustment. The question then naturally arose in the philosophic mind, upon what cause or condition does the existence of these relations of *special homology* depend? Upon this point the anatomical world was divided. The majority of existing authors on comparative ana-

tomy appeared either to have tacitly abandoned, or, with Cuvier and Agassiz, had directly opposed, the idea of the law of special homologies being included in a higher and more general law of uniformity of type, such as has been illustrated by the theory of the cranium consisting of a series of false or anchylosed vertebræ. Profs. De Blainville and Grant, however, teach the vertebral theory of the skull; the one adopting the four vertebræ of Bojanus and the gifted propounder of the theory, Oken; the other regarding the hypothesis of Geoffroy St. Hilaire of the cranial vertebræ as more conformable to nature. Prof. Carus of Dresden has beautifully illustrated the poet Goethe's idea of the skull being composed of six vertebræ. But these authors had left the objections of Cuvier and Agassiz unrebutted; and judging from the recent works of Profs. Wagner, Müller, Stannius, Hallmann, and others of the modern German school, and those of Milne Edwards, the doctrine of unity of organization, as illustrated by the vertebral theory of the skull, seemed to be on the decline on the Continent. To account for the law of special homologies on the hypothesis of the subserviency of the parts so determined to similar ends in different animals—to say that the same bones occur in them because they have to perform similar functions—involve many difficulties, and are opposed by numerous phænomena. Admitting that the multiplied points of ossification in the skull of the human fœtus facilitate, and were designed to facilitate, child-birth, yet something more than a final purpose lies beneath the fact, that all those points represent permanently distinct bones in the cold-blooded vertebrata. And again, the cranium of the bird, which is composed in the adult of a single bone, is ossified from the same number of points as in the human embryo, without any possibility of a similar final purpose being subserved thereby. Moreover, in the bird, as in the human subject, the different points of ossification have the same relative position and plan of arrangement as in the skull of the young crocodile; in which animal they always maintain, as in most fishes, their primitive distinctness. A few errors, some exaggerated transcendentalisms and metaphorical expressions of the earlier German homologists, and a too obvious tendency to *à-priori* assumptions and neglect of rigorous induction on the part of Geoffroy St. Hilaire, had afforded Cuvier apt subjects for the terse sarcasm and polished satire which he directed against the school of "Unity of Organization." The tone also which the discussions gradually assumed towards the latter period of the career of the two celebrated anatomists of the French Academy seems to have led to a prejudice in the mind of Cuvier against the entire theory and transcendental views generally; and he finally withdrew, in the second edition of his 'Leçons d'Anatomie Comparée,' that small degree of countenance to the vertebral theory of the skull which he had given by the admission of the three successive bony cinctures of the cranial cavity in the 'Règne Animal.'

Prof. Owen then briefly alluded to the researches which he had undertaken, with a view to obtain conviction as to the existence or otherwise of one determinate plan or type of the skeletons of the

vertebrata generally; and stated, that after many years' consideration given to the subject, he had convinced himself of the accuracy of the idea that the endo-skeleton of all vertebrate animals was arranged in a series of segments, succeeding each other in the direction of the axis of the body. For these segments or "osteocommata" of the endo-skeleton, he thought the term "vertebræ" might well be retained, although used in a somewhat wider sense than it is understood by a human anatomist. The parts of a typical vertebra were then defined, according to the views explained in the Professor's 'Lectures on Vertebrata'; and he proceeded to apply its characters to the four segments into which the cranial bones were naturally resolvable. The views of the lecturer were illustrated by diagrams of the disarticulated skulls of a fish, a bird, a marsupial quadruped, and the human fœtus. The common type was most closely adhered to in the fish, as belonging to that lowest class of vertebrata in which "vegetative repetition*" most prevailed, and the type was least obscured by modifications and combinations of parts for mutual subservience to special functions. The bones of the skull were arranged into four segments or vertebræ, answering to the four primary divisions of the brain, and to the nerves transmitted to the four organs of special sense seated in the head. Prof. Owen adopted the names which had been assigned to these vertebræ from the bones constituting their neural spines, viz. occipital, parietal, frontal, and nasal; and enumerated them from behind forwards, because, like the vertebræ of the tail, they lose their typical character as they recede from the common centre or trunk. The general results of the Professor's analysis may be thrown into the following tabular form:—

Primary Segments of the Skull-bones of the Endo-skeleton.

VERTEBRÆ.	OCCIPITAL.	PARIETAL.	FRONTAL.	NASAL.
Centrums.	Basioccipital.	Basisphenoid.	Presphenoid.	Vomer.
Neurapophyses.	Exoccipital.	Alisphenoid.	Orbitosphenoid.	Prefrontals.
Neural Spines.	Supraoccipital.	Parietal.	Frontal.	Nasal.
Parapophyses.	Paroccipital.	Mastoid.	Postfrontal.	None.
Pleurapophyses.	Scapula.	Stylohyal.	Tympanic.	Palatal.
Hæmapophyses.	Coracoid.	Ceratohyal.	Articular.	Maxillary.
Hæmal Spines.	Episternum.	Basihyal.	Dentary.	Premaxillary.
Diverging Appendage.	Fore-limb or fin.	Branchiostegals.	Operculum.	Pterygoids and Zygoma.

The upper or neural arch of the occipital vertebra protected the *epencephalon*, or medulla oblongata and cerebellum; that of the parietal vertebra protected the *mesencephalon*, or third ventricle, optic lobes, conarium and hypophysis; that of the frontal vertebra the *prosencephalon*, or cerebral hemispheres; that of the nasal vertebra the *rhinencephalon*, or olfactory crura and ganglions.

The superior development of the cerebral hemispheres in the warm-blooded class, and their enormous expansion in them, occasions corresponding development of the neural spines, not only of their proper vertebra, but, by their backward folding over the other primary segments, of those of all the other vertebræ; whilst the more important

* The general principle of animal organizations, which Prof. Owen has termed "the law of vegetative or irrelative repetition," is explained in the first volume of his 'Hunterian Lectures,—on the Invertebrate Animals.'

parts of the neural arch, as the neurapophyses, undergo comparatively little change.

The acoustic nerve escapes between the occipital and parietal vertebræ, but the organ itself is intercalated between the neural arches of these segments and its ossified capsule; the petrosal projects into the cranial cavity between the exoccipital and alisphenoid in the warm-blooded vertebrata. The gustatory nerve (part of the third division of the fifth pair) perforates or notches the alisphenoid, and in crocodiles and many fishes passes through an intervertebral foramen between the alisphenoid and orbitosphenoid; but the gustatory organ is far removed from the neural arches or cranium proper, and is united with its fellow to form the apparently single organ called the tongue. The optic nerve perforates or grooves the orbitosphenoid, and the eyeball intervenes between the frontal and nasal vertebræ, as the earball does between the occipital and parietal: the vertebral elements are modified to form cavities for these organs of sense; that lodging the eye being called the "orbit," that for the ear the "otocrane."

The divergence of the olfactory crura, and the absence of any union or commissure between the olfactory ganglia, leads to an extension of ossification from their neurapophyses, which are always perforated by the olfactory crura or nerves, to the median line between those parts; and the neurapophyses themselves coalesce together there in batrachia, birds and mammals. This extreme modification was to be expected in a vertebra forming the anterior extremity of the series; and the typical condition of the prefrontals, so well shown in fishes and saurians, is marked in mammals by the enormous development of the capsules of the organ of smell anterior to them, which become ossified and partially anchylosed to the compressed, shrunken and coalesced prefrontals; the whole forming the composite bone called "æthmoid" in anthropotomy. The vomer, or body of the nasal vertebra, has undergone an analogous modification to that which the terminal vertebra of the tail presents in birds; whence its special name, referring to the likeness to a ploughshare, in human anatomy. The spine, or nasal bone, is sometimes single, sometimes divided, like the frontal, the parietal and the supraoccipital bones. Their special adaptive modifications have obtained for them special names.

The hæmal arches corresponding with the above neural arches retain most of their natural position and proportions, as might be expected, in fishes; they are called the scapular, hyoid, mandibular and maxillary arches. The pleurapophysis of the occipital vertebra is the scapula, and is commonly attached by a head and tubercle to the centrum and parapophysis of its proper occipital vertebra.

The hyoid arch is suspended by the medium of the epitympanic to the mastoid parapophysis of the parietal vertebra, the epitympanic, in fishes, intervening and separating the hæmal arch from its proper vertebra, just as the squamosal intervenes to detach the tympanic pleurapophysis of the mandibular arch from its proper vertebra in mammals; which vertebra the squamosal attains in man by articu-

lating with the process representing the coalesced postfrontal. In return, we find the hyoidean arch resuming its normal connexions in many mammalia, the stylo-hyal element being directly articulated to the mastoid: in man the large petrosal capsule intervenes, and contracts that anchylosis with the proximal or pleurapophysial element of the hyoid arch, which has led to the description of the stylohyal as a process of the temporal bone, in works on human anatomy.

In fishes, the tympanic, which is the true pleurapophysis of the mandibular arch, always articulates with the postfrontal, besides its accessory joint with the mastoid. The maxillary arch is articulated by its pleurapophysis, the palatine bone, with the centrum and neurapophysis (vomer and prefontal) of the nasal vertebra. This is the normal and constant point of suspension of the maxillary arch; other accessory attachments to ensure its fixation and strength are successively superinduced upon this primary and essential one. Through this knowledge of the general homology of the palatine, an insight was gained into its singular disposition in man, creeping up, as it were, into the orbit, to touch the pars plana of the æthmoid; this secret affinity with the modified neurapophysis of the nasal vertebra becomes intelligible by a recognition of its relations to the general type of the vertebrate skeleton, by its determination as the rib or pleurapophysis of the nasal vertebra, and therefore retaining, as such, more or less of its essential connexion with the centrum (vomer) and neurapophyses (æthmoid or prefrontal) of the nasal vertebra throughout the vertebrate series.

The tympano-mandibular and the hyoidean arches had both been recognized as resembling ribs. A like homology of the scapula had early been detected by Oken; but its relation to the skull or occiput had been masked, and had escaped previous notice, by its displacement from its natural or typical connexions in all the air-breathing vertebrata.

The enunciation of these correspondences has sometimes been received by anatomists conversant with one particular modification of the general type, with as little favour as those of the "cannon-bone" to the metacarpus, of the "great and small pastern" and the "coffin-bones" to the digital phalanges of the human hand, may be supposed to have been by the earlier veterinarians.

Prof. Owen adduced instances of the displacement of different vertebral elements to subserve special exigencies, as that of the neurapophyses in the bird's sacrum, and that of the ribs in the human thorax, in which there could be, and had been, no question as to the reference of such displaced parts severally to their proper vertebral segments. The displacement of the scapular arch from the occiput was a modification of precisely the same kind, and differed only in degree. In the crocodile every cervical as well as every dorsal vertebra had its ribs; and in the immature animal the same elements existed, as distinct parts, in the lumbar, sacral, and in several caudal vertebræ. The occipital vertebra would be represented only by its "centrum" and "neural arch," unless the loose and obviously displaced scapulo-coracoid arch were recognized as its pleurapophysial

and hæmapophysial elements. This arch made its first appearance in every vertebrate embryo close to the occiput; and in fishes—the representatives of the embryo-state of higher vertebrata, where the principle of vegetative repetition most prevailed, and the primitive type was least obscured by teleological or adaptive modifications—the scapular arch retained its true and typical connexions with the occiput.

The general homology of the locomotive members, as developments of the diverging appendages of the inferior vertebral arches, was illustrated, and the parallelism in the course of the modifications of all such appendages pointed out. As the scapular arch belongs to the skull, so its appendages, the pectoral or anterior members, were essentially parts of the same division of the skeleton segments.

As a corollary to the generalization that the vertebrate skeleton consisted of a series of essentially similar segments, was the power of tracing the corresponding parts from segment to segment in the same skeleton. The study of such "serial homologies" had been commenced by the unfortunate Vicq. d'Azyr, in his memoir "on the parallelism of the fore and hind extremities;" and similar relations could be traced through the more important elements of the series of vertebræ. Prof. Owen believed it to be an appreciation of some of these homologies that lay at the bottom of the epithets, "scapula of the head," "ilium of the head," "femur of the head," &c. applied to certain cranial bones by Oken and Spix. To Cuvier this language had seemed unintelligible jargon; yet the error consisted merely in assigning a special instead of a general name to express the serial homology rightly discerned, in some of the instances, by the acute German anatomists. "Scapula," "ilium," "rib," &c. were names indicative of particular modifications of one and the same vertebral element. Such element, understood and spoken of in a general sense, ought to have a general name. Had Oken stated that the tympanic bone of the bird, for example, was a "pleurapophysis" (or by any other equivalent term) of the head, his language would not only have been accurate, but intelligible, perhaps, to Cuvier. When Oken called it the "scapula of the head," he then unduly extended such special name, and transferred it to a particularly and differently modified pleurapophysis, which equally required to have its own specific name.

Prof. Owen dwelt on the necessity of having clearly-defined terms for distinct ideas, in order to ensure the progress of science; and alluded to the advancement of human anatomy by accurate determinations of the general type, of which man's frame was a modification. —*From the Literary Gazette.*

BOTANICAL SOCIETY OF EDINBURGH.

January 14, 1847.—Sir William Jardine, Bart., in the Chair.

The following communications were read:—

1. "On Fairy Rings," by Dr. George Wilson. The object of Dr. Wilson's remarks was to show that the chemical theory of the

origin of these remarkable circles, laid before the meeting of the British Association, held at Southampton in September 1846, by Professor Way of the Agricultural College at Cirencester, was identical with that published by Wollaston in the 'Philosophical Transactions' for 1807. Dr. Wilson also pointed out that analyses of various fungi had been made by Professor Schlossberger of Tubingen and Dr. Doepping, and thought that these gentlemen's names deserved to be mentioned, as confirmers of Wollaston's views and predecessors of Professor Way, in establishing the probability of the chemical theory of Fairy Rings. To Professor Way, on the other hand, belonged the twofold merit of being the first to analyse Agarics actually taken from Fairy Rings, and the first to supply a detailed qualitative and quantitative analysis of the ashes of these fungi.

Dr. Balfour made remarks on the views of botanists relative to centrifugal development, and endeavoured to show that a combination of the botanical and chemical theories was necessary to account for the phænomenon.

Dr. Fleming thought that none of the theories were sufficient to account for the so-called fairy Rings in all cases; and alluded to the occurrence of fungi, especially *Agaricus oreades*, in a circular arrangement without any alteration in the grass.

Sir Wm. Jardine agreed with Dr. Fleming; and stated that the growth of fungi in lawns was often not in a circular manner, but of various forms, and without altering the appearance of the grass. He then briefly noticed the points which still required determination, and urged upon botanists the importance of attending to them.

2. Supplement to "A Synopsis of British Rubi," No. 2, by Charles C. Babington, M.A. See 'Annals,' p. 83 of the present volume.

MISCELLANEOUS.

Description of a new genus and species of Entozoa. By Joseph Leidy, M.D.

In the course of an investigation of the anatomical structure of the terrestrial Gasteropoda of the United States, I discovered a microscopic Entozoon inhabiting the fluid contained in the vessie copulatrice or spermatheca of *Helix albolabris*, since which I have found it to exist in two other species, *Helix tridentata* and *Helix alternata*, and I have no doubt of its existence in others, not yet having had an opportunity of examining further. As there appears to be no known genus in which this animal can be placed, I have been necessitated to form the following:—

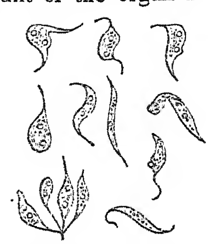
Cryptobia. Animal minute; form exceedingly proteoid; internal organization cellular or granular.

C. helicis. Colourless; form ordinarily elongate, ellipsoid, fusiform or ovate; caudated, caudæ opposite, one longer than the other. Internal granular structure consisting of two large cells and numerous minute granules. Total length from the 125th to the 100th of

a line. Habitat, the vessie copulatrice or spermatheca of *Helix albolabris, Helix tridentata,* and *Helix alternata.*

This singular Entozoon in its general appearance and organization appears to be intermediate between *Cercaria seminis* and *Filaria.* Its varied form and movements are curious to observe; at one moment globular, then oval, ovate, fusiform, sigmoid, crescentic, &c., it appears as if it would outvie the kaleidoscope in its changes. The motions are vibratile, rotary, with a lateral progression, or whirling in circles like the insect *Gyrinus.*

Cryptobia helicis might be confounded with the Spermatozoa of the animal in which they are parasitic, on account of the organ in which they are found being connected with the generative apparatus and its supposed use as a spermatheca, but they may be readily distinguished; the Spermatozoa of Helices generally having either a uniform sigmoid or a beaded body, with an enormous proportionate length of tail, and a slow, vibratile motion. It may be well to mention that *C. helicis* does not exist in the collapsed state of the generative organs.



The subjoined sketch represents some of the principal forms of the animal, highly magnified.—*From the Proceedings of the Philadelphia Academy of Natural Sciences.*

Description of two living Hybrid Fowls, between Gallus *and* Numida. By Samuel George Morton, M.D.

The singular birds which form the subject of this communication were bred on a farm about seven miles from Wilmington, in the State of Delaware. The person who raised them states that the eggs that produced them differed in no respect from those of the guinea fowl, were part of a large number that were hatched at the same time, and that the birds are known to be just four years old. My friend Mr. Augustus E. Jessup having accidentally observed these birds on the above-mentioned farm, purchased them of the proprietor, and sent them to my care, with a request that they might be eventually placed in the collections of the Academy. Both are yet living and in good health; and the following description, in which I have been materially assisted by my friend Mr. William Gambel, has been drawn up after many examinations, made during a month and upwards that the birds have been in the charge of Mr. Robert Kilvington, horticulturist of this city.

The first of these birds is mottled with the colour of a reddish brown chicken and guinea fowl (*Numida meleagris*). Back and rump lineated with darkish brown and whitish, and a tinge of yellowish brown. Greater wing-coverts and margins of secondaries reddish brown; breast, belly, sides and under tail-coverts dirty white, with scattering feathers of the same. Quills and tail-feathers dusky brown, lineated, and finely speckled like those of the guinea fowl. Two quills in one wing and one in the tail are entirely white. Wings concave and rounded, one foot in length from flexure. First

quill an inch and a half shorter than the second, which last is one inch shorter than the third; 3—8 quills about equal. Tail of fifteen feathers, rounded; the two middle ones longest and pointed.

Head sparsely covered with feathers, almost bare for a considerable distance around the eye. Upper mandible dusky, except at tip, which, with the lower mandible, is whitish; towards the base it is somewhat striated, and covered by a reddish, fleshy cere, elongated at the angle of the mouth into barbles, which however are only rudimentary in comparison with those of the guinea fowl. Beneath the skin a distinct, hard, bony ridge can be felt, extending over the top of the head. Another bony ridge extends over the eye, giving it a sunken appearance. The nostrils are half-closed by a fleshy membrane; sides of head and front white. Top of head and nape with linear black feathers, elongated on the nape into hackles. Neck and upper part of the breast reddish brown. Tarsus very stout, with large, divided scutellæ; length $3\frac{1}{2}$ inches; middle toe and nail $2\frac{3}{4}$ inches. Total length about 2 feet.

The second of these birds bears yet more resemblance to a guinea fowl, both in shape and colour, than the preceding, not being so much mottled with reddish brown feathers, but principally with white. The bill appears to be not so much arched; the upper mandible is barbled as in the other, and the head is in general the same. Back, shoulders and upper tail-coverts dusky, lineated with whitish like the guinea fowl; greater wing-coverts fading into white, the tertiaries being margined with the same. One quill white. Quills like the other as to colour and markings; third to sixth nearly equal. From flexure the wing measures $11\frac{1}{2}$ inches.

Back of head and neck with black linear feathers, not so much like hackles as those of the other bird. Breast, beneath and sides whitish. Tail nearly plucked out, as in the other; upper tail-coverts full and pendent. The bare flesh around the eye in both birds is tinged with blue.

The sounds which these birds utter are also intermediate, but partake much more of the harshness of the guinea fowl, although they occasionally *cluck* not unlike the common hen.

They are shy, wild and resentful, boldly attacking any one who irritates them. They have several times escaped from custody and flown a hundred yards or more, when they alight and run with great celerity.

The sex of these birds has not been determined with certainty, but the male characters seem to predominate. During the four years they were on the farm, they were never observed to have sexual intercourse with any other fowls. It is designed on a future occasion to notice their anatomical peculiarities, when the productive organs will be carefully examined.

It has been remarked by a distinguished naturalist, that "many of the birds which compose the gallinaceous order appear to be less difficult to unite with strange species than those of any other order. From the great majority of pheasants, mongrels may thus be produced; all the Hoccos (*Crax*) will couple together in a state of do-

mestication; the pheasant will ally with the cock; the last with the turkey, with which the hoccos born in the domestic state will also unite. It appears, in fact, very possible to produce mongrels from the major part of those *Gallinæ* which are susceptible of domestication*."

The latter remark receives strong corroboration from the facts we have adduced in this paper; and we believe that a hybrid progeny between the guinea fowl and common fowl is now for the first time made known to naturalists. The fact derives its peculiar interest from the remoteness of the genera which have thus produced an intermediate variety.—*Ibid.*

On the Habits of the Honey Buzzard in Confinement. By Gordon Jos. Forster, Esq.

The Honey Buzzard now in my possession was wounded in the wing, and taken about three months ago. It was at first confined in a small garden-house, and for a day or two refused to eat anything, but at last began to feed upon small birds, but would not touch raw flesh or any kind of offal, nor has it yet done so, although it has not the smallest objection to a rat or a frog. Many birds of prey, after eating the muscular parts of any animal or bird, leave the entrails untouched; the Honey Buzzard, on the contrary, generally begins by opening the carcase, and then devouring everything it finds within it. It is very fond of the honeycomb of the wild bee, and when hungry will swallow large pieces of the comb containing the grub or larvæ, but when its appetite is not very keen it usually separates the cells, extracts the grub, and throws the wax away. There has been little honey in the combs this year, but when perchance any has dropt from the cells upon the ground, I have seen the bird repeatedly thrust its bill into the earth, where it appeared to be moistened by the honey. Unless very hungry it will not attempt to tear open a large bird, but is exceedingly fond of a fresh herring. There is something capricious in the appetite of birds, as well as in that of the human race. I had an eider duck for three years, and during that time it never could be prevailed upon to taste shell-fish; its favourite food was barley bread, though if grain of any kind was thrown down to it, it would devour it in the same manner and with the same rapidity as the common duck. Of all the birds of prey with which I am acquainted, the Honey Buzzard is apparently the gentlest, the kindest, and the most capable of attachment; it seems to possess little of the fierceness of that warlike tribe. It will follow me round the garden, cowering and shaking its wings, though not soliciting food, uttering at the same time a plaintive sound, something like the whistle of the golden plover, but softer and much more prolonged. Though shy with strangers, it is very fond of being noticed and caressed by those to whose presence it has been accustomed. In the same garden there are three lap-

* Griffith's Cuvier, viii. pp. 173, 175, 176. Prichard, Researches into the Physical History of Mankind, i. p. 140, 3rd ed.

wings, a blue-backed gull, and a curlew. The plovers are often seen with the buzzard sitting in the midst of them, showing no signs of caution or apprehension, but seem as if they were listening to a lecture delivered by him. The gull frequently retires into the garden-house, probably to enjoy the society of the buzzard. The garden is not the garden of Eden, and yet these birds, of different natures, habits and dispositions, appear to live in perfect harmony, peace and good fellowship with each other. G. J. F.

Newton-by-the-Sea, Aug. 29, 1845.

P.S.—I have had three living specimens of the Honey Buzzard in my possession, not one of them in plumage at all resembling the other. One of the three never could be induced to take any food, and after living about a fortnight, died, I believe, from pure inanition. Besides the plaintive cry above-mentioned, the Honey Buzzard has another and more varied note apparently of alarm.—*From the Transactions of the Berwickshire Naturalists' Club*, vol. ii. p. 173.

LARUS EBURNEUS.

On Monday last Michael Roberts of Penzance, who devotes a considerable portion of his time and attention to the subject of ornithology, succeeded in shooting, off the pier head, a very excellent specimen of the ivory gull (*Larus eburneus*). We believe that the first specimen of this species obtained in the United Kingdom was at Balta Sound, Shetland Islands, in the winter of 1822. The length of these birds varies from 16 to 18 inches, depending upon age and sex. Captains Sabine and J. C. Ross represent this species as common on the coast of Greenland, Davis' Straits, Baffin's Bay, Port Bowen and Hecla Cove. Dr. Richardson mentions these birds as having been seen breeding in great numbers in the high perforated cliffs which form the extremity of Cape Parry, in lat. 70°.—*Cornwall Royal Gazette*.

FOSSIL HUMAN BONES.

At a Meeting of the Academy of Natural Sciences, Philadelphia (Oct. 6, 1846), Dr. Dickeson exhibited a large and remarkably varied series of fossil bones, obtained by him from the vicinity of Natchez, Miss. The collection embraces the entire head and half of the lower jaw of the *Megalonyx Jeffersoni* *, now for the first time discovered; together with many parts of the skeleton, and indeed of several skeletons of that animal, sufficient to enable its complete osteological reconstruction. The stratum that contains these organic remains is a tenacious blue clay that underlies the diluvial drift east of Natchez, and which diluvial deposit abounds in bones and teeth of the *Mastodon giganteum*.

* Dr. Dickeson originally suggested, from partial comparisons, that this cranium belonged to the *Megalonyx*, and not to the *Mylodon* as others had supposed; his opinion was fully confirmed by M. Agassiz on a recent examination; and this distinguished naturalist has proved the *Megalonyx laqueatus* of Harlan to belong, not to *Megalonyx*, but to some other nearly allied genus.

The animals associated with the Megalonyx are, an Ursus, a Bos, two species of Cervus, one or two species of Equus, and several undetermined genera, all which are now in progress of delineation and description for the Academy's Journal.

Dr. Dickeson presented another relic of yet greater interest, viz. the fossil *os innominatum* of the human subject taken from the above-mentioned stratum of blue clay, and about two feet below the skeletons of the Megalonyx and other extinct genera of quadrupeds.

This ancient relic of our species is that of a young man of about sixteen years of age, as determined by its size and form, and by the fact that the epiphyses have separated from the tuberosity of the ischium and from the crista of the ilium. Nearly all the os pubis is wanting, the upper posterior part of the ilium is broken away, and but half the acetabulum remains. That this bone is strictly in the fossil state is manifest from its physical characters, in which it accords in every respect of colour, density, &c. &c. with those of the Megalonyx and other associated bones. That it could not have drifted into the position in which it was found is manifest from several facts:—1. that the plateau of blue clay is not appreciably acted on by those causes that produce ravines in the superincumbent diluvial; 2. that the human bone was found at least two feet below three associated skeletons of the Megalonyx, all which, judging from the apposition or proximity of their several parts, had been quietly deposited in this locality, independently of any active current or other displacing power; and lastly, because there was no admixture of diluvial drift with the blue clay, which latter retains its homogeneous character equally in the higher part that furnished the extinct quadrupeds, and in its lower part that contained the remains of man. Dr. Dickeson has announced his intention of returning, at an early period of the present autumn, to resume his explorations in this prolific and most interesting locality; and it is earnestly hoped that his researches may lead to a further elucidation of this important question in science.

On the Mechanism which closes the Membranous Wings of the genus Locusta. By Joseph Leidy, M.D.

The membranous wings or alæ of the locusts while at rest are folded up, like a closed fan, beneath the anterior pergamentaceous wings. These are opened or expanded by the contraction of appropriate muscles (extensores alæ) contained within the thorax, the tendons of which are inserted into the ribs or longitudinal veins at the root of the wings. When one of the wings is separated from the body of the insect and stretched open by the fingers, upon letting go it will be found instantly to close or resume the position of rest.

The mechanism which produces this closure in the separated wing, as well as when attached to the living animal, I find to be spiral ligamentous bands, wound, like the thread of a screw, around the transverse or connecting veins, which latter are also flexible. By this arrangement, upon the contraction of the alary extensors, the

spring-like ligaments, or ligamenta spiralia as I will call them, are stretched in the expansion of the wings, and upon the relaxation or cessation of the action of the muscles, the physical properties alone of the ligamenta spiralia, in resuming their unstretched state, close the wings. These ligamenta spiralia are numerous, and exist in all the species of *Locusta* possessing perfect alæ which I have examined. —*Proceedings of the Philadelphia Academy of Natural Sciences.*

ON THE GENUS CALOPTYLUM.

A mistake occurred in the notice which appeared in our last Number on this subject, the 'Annals' being referred to as the work in which Mr. Thompson's paper was published, whereas it should have been Charlesworth's 'Magazine of Nat. Hist.' vol. iv. p. 184. —Ed.

METEOROLOGICAL OBSERVATIONS FOR JAN. 1847.

Chiswick.—January 1. Frosty: overcast. 2. Hazy and cold. 3. Dry haze: snow at night. 4. Cloudy. 5. Hazy. 6, 7. Foggy. 8. Hazy. 9. Cold: hazy. 10. Sharp frost at night. 11. Frosty: fine: sharp frost. 12, 13. Foggy. 14. Sharp frost: foggy: frosty. 15, 16. Dense fog: frosty at nights. 17. Dry haze: foggy. 18. Cloudy and cold. 19. Overcast: hazy. 20. Slight haze: snow at night. 21. Snowing. 22. Dense fog throughout. 23. Slight fog: cloudy: rain. 24. Densely clouded: rain: clear. 25. Fine: slight showers in the evening. 26. Partially overcast: fine: boisterous at night. 27. Clear: rain at night. 28. Boisterous: clear and frosty. 29. Fine, with sun: clear and frosty. 30. Clear and frosty: fine: densely overcast. 31. Light haze: cloudy: fine.

Mean temperature of the month	34°·26
Mean temperature of Jan. 1846	43 ·54
Mean temperature of Jan. for the last twenty years ...	36 ·81
Average amount of rain in Jan.	1·60 inch.

Boston.—Jan. 1. Foggy: snow on the ground. 2, 3. Cloudy. 4. Cloudy: snow early A.M. 5. Cloudy: rain early A.M. 6. Cloudy. 7. Rain. 8—11. Cloudy. 12. Cloudy: rain P.M. 13. Cloudy. 14—16. Fine. 17—20. Cloudy. 21. Cloudy: snow P.M. 22. Cloudy: snow on the ground. 23. Cloudy. 24. Cloudy: snow nearly all melted. 25. Fine: rain midday. 26. Fine. 27. Windy. 28. Rain. 29—31. Fine.—This January has been the coldest since January 1842, and the driest since 1833.

Sandwick Manse, Orkney.—Jan. 1. Fog. 2. Cloudy. 3. Damp: showers. 4. Showers. 5. Showers: rain. 6, 7. Damp. 8. Cloudy. 9. Bright: clear. 10—12. Bright: frost: clear. 13. Bright: clear. 14. Bright: frost: clear. 15. Bright: clear. 16. Drops: cloudy. 17—19. Cloudy: clear: aurora. 20. Fine: frost: clear: frost: aurora. 21. Sleet-showers. 22. Bright: clear. 23, 24. Cloudy: rain. 25—27. Bright: clear. 28. Clear: frost: cloudy. 29. Bright: clear. 30. Bright: snow-showers: aurora. 31. Hail-showers: snow-showers: aurora.

Applegarth Manse, Dumfries-shire.—Jan. 1. Clear, but moist. 2. Dull and raw: slight snow. 3. Slight frost: very chilly. 4. Dull: slight frost: rain P.M. 5. Dull: rain. 6. Fine and fair. 7, 8. Fair, but cloudy. 9, 10. Frost: clear. 11—13. Frost, hard. 14. Frost, hard, but cloudy. 15. Thaw. 16. Thaw: drizzle. 17—21. Frost again. 22. Frost: snow: thaw. 23. Thaw: sleet. 24. Heavy rain. 25. Slight frost A.M.: rain. 26. Heavy rain. 27. Rain: cleared P.M. 28. Fair, but dull. 29. Slight frost A.M. 30. Slight frost A.M.: cloudy. 31. Hard frost: snow P.M.

Mean temperature of the month	35°·97
Mean temperature of Jan. 1846	43 ·0
Mean temperature of Jan. for 25 years	34 ·9
Mean rain in Jan. for 20 years	2·60 inches.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse,* Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. Jan.	Max.	Min.		9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9½ a.m.	8½ p.m.								
○ 1.	30·311	30·150	30·06	30·28	30·15	30·40	30·33	35	29	32	44½	36	47	45	ne.	calm	ene.	e.	......	......	......	·14
2.	29·981	29·820	29·80	30·04	29·83	30·20	30·10	34	26	35	43½	36	41½	41	e.	calm	ese.	se.	......	......	......	·01
3.	29·700	29·663	29·51	29·67	29·65	29·97	29·92	35	30	32	38	34	39	38½	e.	calm	e.	ese.	·14	......	......	......
4.	29·782	29·746	29·50	29·59	29·54	29·79	29·73	43	39	35	40½	32½	39	42½	se.	calm	e.	se.	·04	......	......	·10
5.	29·890	29·832	29·57	29·63	29·70	29·84	29·92	46	33	39·5	45	38	44	44½	e.	calm	e.	sse.	·05	·13	......	·05
6.	30·065	29·976	29·70	29·84	29·90	30·00	30·02	43	40	42	47	41	43	43	ne.	calm	ese.	sse.	·02	......	......	·34
7.	30·057	29·986	29·78	29·91	29·87	30·01	30·00	42	37	41	45	43	43½	44	e.	calm	ese.	se.	·01	......	......	......
8.	30·197	30·069	29·78	29·96	30·08	30·10	30·22	39	34	40	44½	41	45	41	e.	s.	ese.	sse.	......	·07	0·28	......
☾ 9.	30·333	30·311	30·07	30·19	30·19	30·23	30·20	36	22	36	37	32	40	38	e.	calm	e.	sse.	......	......	......	......
10.	30·298	30·201	30·07	30·10	30·04	30·10	30·05	33	24	33	35	30	38	37½	se.	calm	e.	sse.	......	......	......	......
11.	30·162	30·070	29·94	30·00	29·90	30·05	30·03	34	21	31	32	26	35	36	e.	calm	e.	......	·04	......	......	......
12.	30·018	29·881	29·80	29·88	29·86	29·99	29·95	36	27	30·5	32	20½	38	38	ne.	calm	ene.	se.	......	......	......	......
13.	29·928	29·846	29·65	29·75	29·78	29·98	29·83	38	21	35	34	19½	39	38½	ne.	calm	ne.	sse.	......	·03	......	......
14.	30·046	29·995	29·74	29·80	29·85	29·82	29·91	35	19	31	38	23	36	42	e.	calm	nne.	s.	......	......	......	......
15.	30·150	30·008	29·80	29·80	29·79	29·85	29·85	36	21	30·5	46½	23	43	41½	ne.	calm	ese.	sse.	......	......	0·00	......
16.	30·083	29·997	29·82	29·90	30·00	30·05	30·16	36	27	29	42	36½	41½	40	e.	calm	e.	sse.	......	......	......	......
● 17.	30·114	29·998	29·90	30·02	30·00	30·13	30·10	31	28	31	35½	28	40	37	ne.	e.	e.	se.	......	......	......	·05
18.	30·112	30·084	29·86	29·98	30·02	30·10	30·14	32	28	32	35	31½	39	39	e.	e.	e.	s.	......	......	......	......
19.	30·131	30·068	29·86	30·03	29·97	30·15	30·10	33	26	32	35	32	39	38	n.	calm	e.–s.	se.	......	......	......	......
20.	30·097	29·969	29·73	29·90	29·81	30·04	29·97	36	25	29	34	28½	35	36	ne.	calm	e.	e.	......	......	......	......
21.	29·896	29·788	29·63	29·73	29·67	29·93	29·88	36	30	30	37	27	38	37½	s.	calm	e.	se.	·48	......	......	......
22.	29·758	29·736	29·55	29·00	29·55	29·77	29·71	36	30	33	36	32½	39½	37	e.	calm	e.	se.	·01	......	......	......
☽ 23.	29·786	29·628	29·44	29·48	29·32	29·63	29·49	44	34	34·5	36½	33	38½	36	s.	s.	e.	se.	·02	......	0·54	......
24.	29·416	29·245	29·16	29·04	28·89	29·17	28·90	48	38	39	43½	34	40	41	sw.	s.	se.	se.	·23	·27	......	·26
25.	29·323	29·303	28·97	29·89	28·82	28·90	28·89	47	33	39	44	35½	39	41	sw.	calm	se.–s.	sse.	·02	·20	......	·18
26.	29·449	29·259	29·04	28·96	28·75	28·83	28·83	50	41	38·5	46½	39½	42	43	sw.	calm	s.	se.	·02	......	......	·03
27.	29·385	29·258	28·88	28·85	28·90	28·83	28·93	49	40	45·5	46	39½	41	40½	sw.	n.	s.	s.	·21	......	......	......
28.	29·275	28·990	28·50	28·72	28·93	28·93	29·00	47	25	43	46	37½	37½	38	sw.	s.	w.	e.	·02	·19	......	......
29.	29·367	29·305	28·93	29·04	29·19	29·16	29·35	44	21	35	44	33½	37½	38	sw.	calm	wsw.	n.	......	......	......	·18
30.	29·538	29·474	29·14	29·39	29·53	29·61	29·72	46	33	36	41	33	39	35	w.	calm	nne.	n.	......	......	0·56	·08
○31.	29·624	29·593	29·32	29·60	29·66	29·83	29·86	41	21	33·5	43½	28½	35	33	n.	calm	nnw.	n.	......	·09	......	·09
Mean.	29·880	29·782	29·56	29·692	29·659	29·786	29·777	39·39	29·13	34·9	40	32·1	39·75	39·38					1·31	0·98	1·38	1·51

THE ANNALS

AND

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XXV.—*Notes on the genus of Insects* Trachyphlœus, *with descriptions of new species.* By John Walton, F.L.S.

Fam. CURCULIONIDÆ.

Genus Trachyphlœus, *Germ., Schönh., Steph.*

1. *Trachyphlœus scaber*, Linn., Mus. Linn., Germ.
— *tessellatus*, Marsh., Steph., Schönh.
— *confinis*, Steph. secund. ejus Mus.
Curc. scabriculus, Payk., Gyll., Schönh., non Linn.
— *bifoveolatus*, Beck, Germ.
Strophosomus nigricans, Steph., Kirb. MSS. et Mus.
Thylacites grisescens, Kirb. MSS. et Mus.

According to the museum of Linnæus and to his description, this insect is the true *Curc. scaber* of that illustrious naturalist, and it is specifically identical with *Curc. tessellatus* of Marsh.

I regret that I cannot concur with M. Schönherr and Dr. Germar in considering this insect as specifically distinct from *Curc. scabriculus* of Payk. I apprehend that the want of time to detach the scales and the extraneous matter from the upper surface of the thorax by which the sculpture is obscured, and the want of a long series of specimens to exhibit a variation of size and of form in the elytra, have led those distinguished entomologists into an error; otherwise it is impossible to reconcile the discrepancies between themselves and Gyllenhal.

I possess a series of forty-three specimens (thirty of which I have denuded to obtain a distinct view of the sculpture), and have very closely and minutely examined and compared them with four authentic specimens of *Curc. bifoveolatus* of Beck from Germar, but I am unable to discover a uniform distinctive difference, and have no doubt that they are specifically identical. Gyllenhal, Schönherr and Germar have cited *Curc. bifoveolatus* of Beck as synonymous with *Curc. scabriculus* of Payk., therefore the latter

is synonymous with *Tr. scaber*; however, in deference to the great authorities above named, it is necessary to show better reasons for venturing to dissent: according to Schönherr, "*Curc. tessellatus* of Marsh. (from an examination of British specimens) differs from *Curc. scabriculus* by having the thorax *equal*, neither *canaliculated* nor *impressed*; the elytra more *globose* and *deeply punctate-striate**." According to Germar, "*Tr. scaber* of Linn. (*Curc. tessellatus* of Marsh.) has the thorax obsoletely *canaliculated* and *bifoveolated* posteriorly; the elytra *ovato-globose* and *punctate-striate*; it is very like *Tr. bifoveolatus*, and differs almost only by its shorter elytra, the greatest breadth of which is in the *middle*†." "*Tr. scabriculus* has been sent to me by Schönherr himself, and to it *Curc. bifoveolatus* of Beck belongs; it has the thorax with *scarcely any central furrow*, and the elytra *scarcely exhibit striæ*, and its greatest breadth is *beyond* the *middle*‡."

Nevertheless the whole of my denuded specimens, and also the four examples of *Curc. bifoveolatus* sent to me by Germar himself, have the thorax more or less *unequal*, *distinctly bifoveolated* and *furrowed*; the elytra ovate, more or less convex, *gibbous beyond the middle*, and very distinctly punctate-striate; as to the form of the elytra it is subject to variation, and has a tendency, especially in large and in fully matured specimens, to become more convex, and varies from ovate to globose-ovate: this insect agrees in all its essential characters with the excellent description of *Curc. scabriculus* by Gyllenhal; but he very justly observes, that unless the upper surface is denuded, the sculpture is scarcely perceptible.

Of this species it may be useful to notice, that the inequality and the sculpture of the thorax, above and at the sides posteriorly, have a most extraordinary range of variation, and although it is constantly more or less distinctly canaliculated, bifoveolated, and closely and minutely granulated or rugulose-punctate, yet in the major part of my specimens, these characters are interspersed with a greater or less number of scattered acute tubercles, or rugged with short ridges or tubercles, whilst in others they are obsolete or entirely absent: it may be distinguished from every other species by having the head invariably with a transverse striga or constricted at the base, and by the anterior tibiæ being armed in both sexes at their apices, externally and in front, with six minute spines, which hitherto, as far as I know, have not been noticed.

I intend ultimately to deposit in the cabinets of the British

* Syn. Ins. Suppl. vii. p. 114.

† Germ. Stett. Ent. Zeit. 1842, p. 102.

‡ *Ibid.*

Museum and of the Entomological Society a series of specimens to illustrate the varieties of this insect.

Frequently found, but not plentifully, on Hampstead Heath, Plumstead, Charlton, Birch Wood, &c., generally in sand-pits, sandy banks or gravel-pits in June.

2. *Trachyphlœus Waltoni*, Schönh.
— *ventricosus*, Steph., non Germ.

Ovate, black, densely clothed with griseous and cinereous recumbent scales, and with white erect scales. Head short, depressed, deeply striated and ridged above, beneath, and at the sides, not punctulated; eyes small, round and prominent; rostrum rather narrower and scarcely longer than the head, rugulose, deeply excavated above, with a slender channel in the middle, which extends to the front of the head. Antennæ rufo-ferruginous. Thorax broader in the middle than long, considerably narrowed, but not constricted anteriorly, the anterior margin flat, greatly dilated and rounded at the sides towards the base, convex above, finely carinated, neither furrowed nor foveolated, thickly punctulated, the punctures confluent. Elytra ample, globose-ovate, very convex above, regularly punctate-sulcate, the punctures large and deep, the interstices narrow, convex and coriaceous, densely clothed with cardiform, recumbent griseous scales, variegated with cinereous behind the middle, and with claviform erect white scales; the cardiform scales under a microscope are beautifully and distinctly striated and ridged. Legs rather short, robust, fusco-ferruginous, clothed with griseous and cinereous scales; the anterior tibia at the apex externally and in front unarmed. Length $1\frac{1}{2}$ to $1\frac{3}{4}$ line.

This very distinct species may readily be known by the longitudinal striæ and ridges which surround the head; the deep sulci with large punctures on the elytra; and the want of spines at the apex of the anterior tibia, externally and in front.

I forwarded specimens of this insect to Schönherr and Germar as *Tr. ventricosus* of Germ.?—the former observed "non *ventricosus* of Germ., *Waltoni* of Schönh." *—the latter remarked, "*Tr. ventricosus* of Steph. is different from *Tr. ventricosus* of Schönh., and is a distinct species, which Schönherr will describe in his 'Supplement' as *Tr. Waltoni*†."

Rare, occasionally found in a gravel-pit on Plumstead Common, and at Shirley Common by Mr. S. Stevens and by myself in June and July; found under a stone near Bridgenorth, Shropshire, by Mr. Marshall; south of Ireland by Mr. T. V. Wollaston.

* Syn. Ins. Suppl. vii. p. 115.
† Germ. Stettin Ent. Zeit. 1842, p. 102.

3. *Trachyphlœus scabriculus*, Linn., Fab., Mus. Banks., Herbst, Marsh., Steph., Kirb. MSS.
 — *setarius* (♀) Schönh.
 — *scaber*, Schönh. Syn. Ins. Suppl. vii. p. 117.
 — *maculatus* (var. β.), Schönh. in litt. olim.
 — *digitalis*, Steph. secund. ejus Mus.
 — *occultus*, Chevr. in litt.

According to the description of Linnæus, and to an insect in the Banksian cabinet, named *Curc. scabriculus* of Linn. by Fabricius, it appears that this insect is correctly referred to Linnæus by British authors.

There is considerable difficulty in reconciling the notices of *Tr. scabriculus* and *Tr. scaber* by Schönherr with those of Germar and of himself, and I fear I am in some measure responsible for the discrepancies. In October 1840 I sent to M. Schönherr, among many other insects, three specimens of this as *Tr. scaber*, Mus. Linn., and as *Tr. scabriculus*, Mus. Banks., and the same of Marsh. and of Steph.: I was led into this error by there being three insects in the Linnæan cabinet, so placed as to induce a belief that they were all alike, whereas I subsequently discovered that only one had attached to it the name of '*scaber*,' and that it differed from the others which were really *Tr. scabriculus*; this I greatly regret, as it appears to have induced M. Schönherr on my authority to refer this insect incorrectly to *Tr. scaber* of Linn., by which much confusion in the synonymy has been created. I sent specimens to Germar as *Tr. scabriculus* of Fab., Mus. Banks., Marsh., Kirb. and Steph.: he remarked, "Your specimens seem to me to be the true *Curc. scabriculus* of Linn., and were new to my collection."

Recent and immature varieties not unfrequently occur of smaller size, with the body rufous or ferruginous; the elytra variegated with cinereous and fuscous scales and densely clothed with erect white scales; these varieties, without a long series of specimens and a very close comparative examination, are very liable to be considered as distinct species: of this variety I sent specimens to Schönherr as a new species which he named *Tr. maculatus*, but he subsequently referred it to this insect as a variety*. I likewise sent similar specimens as *Tr. maculatus* of Schönh. to Germar, who observed, "I believe it to be *Tr. setarius* of Schönh. and *scabriculus* of Herbst†;" he also sent me a foreign specimen which clearly belongs to this variety, as do specimens forwarded to me by Chevrolat as *Tr. occultus*.

Tr. scabriculus is chiefly distinguished by having the thorax greatly dilated and rounded at the sides, and having in front a

* Syn. Ins. vii. p. 117.

† *Ib.* ii. p. 492.

small fascicle of scales which has the appearance of a small spine, the anterior margin strongly elevated, deeply constricted in front, with a deep dorsal furrow, and with a small impressed furrow on each side near the posterior angles; the elytra ovate-spherical, distinctly punctate-striate, sometimes maculated or variegated posteriorly with white and fuscous scales, and the erect scales more or less abraded; the anterior tibia of the male has at the apex externally a strong tooth, and another in front which is bifid at its extremity; the female has similar appendages, but they are very minute.

Certainly the most abundant insect of the genus, and found in similar situations and in the same localities as *Tr. scaber*.

4. *Trachyphlœus squamulatus*, Oliv. (1789), Schönh.
   — *aristatus*, Gyll. (1827), Schönh.
   — *stipulatus*, Germ.
   — *hispidulus*, Steph. Illustr.
   Curc. setosus, Kirb. MSS.

British specimens of this insect, which I presented to Schönherr and Germar, were identified by them as *Tr. aristatus* of Gyll. I possess an insect under that name from Germar which agrees with my series of specimens. I have adopted the oldest name for this insect on the authority of Chevrolat, who sent to me on two several occasions examples of *Tr. squamulatus* of Oliv., which is very distinctly a small immature variety of *Tr. aristatus* of Gyll.; yet Gyllenhal has described the former (from a specimen also sent by Chevrolat) as specifically different from the latter, but I am persuaded the want of varieties of this rare and variable insect has led him into an error. It is necessary to make a few observations having reference to the differences between the two descriptions of *Tr. aristatus** and *Tr. squamulatus*† by Gyllenhal. The major part of my specimens have the head, rostrum and thorax black, with the elytra ferruginous or piceous, but immature specimens occur entirely rufous or rufo-ferruginous; all have the antenna inserted near the apex of the lateral furrow on the rostrum near to the mouth; yet when the scape is placed at right angles with the rostrum, the antenna seems to be inserted in the middle, but the scape is curved just at the base in front, and must be extended forward to see the true point of insertion; the small and proportionably narrow specimens have the thorax comparatively less expanded at the sides, and all my British and foreign specimens have the thorax constantly and distinctly rugulose-punctate, not obsoletely alutaceous; the greater part have either the dorsal furrow or the fovea distinct or indistinct, in others they are very obsolete.

* Gyll. Ins. Suec. iv. p. 613. † Schönh. Syn. Ins. ii. p. 492.

Readily distinguished from every other species except *Tr. Waltoni* by having the anterior tibiæ in both sexes unarmed at their apices externally and in front.

I may refer to the cabinet of Mr. S. Stevens for a good series of specimens of this insect with several interesting varieties.

Rather rare, occasionally found on sandy banks on Windmill Hill, Gravesend; also near Birch Wood, and Bishop's Wood, Hampstead, in June.

5. *Trachyphlœus alternans,* Schönh. Syn. Ins. ii. p. 493.

Ovate, black, densely clothed with recumbent cinereous-ochraceous scales (generally incrusted with earth), and very sparingly with short, suberect scales. Head short, broad, thickly and minutely rugose-punctate; eyes small, semiglobose; rostrum almost as broad, and rather longer than the head, concave above, rugulose-punctate, and finely canaliculated in the middle. Antennæ obscure testaceous. Thorax short, transverse, narrowed and transversely impressed in front, the anterior margin elevated, greatly dilated and rounded at the sides, a little convex above, closely and minutely rugose-punctate, interspersed with scattered small tubercles and not furrowed. Elytra ample, ovate, convex above, distinctly punctate-striate, the alternate interstices slightly raised, minutely granulated, and clothed with a series of short, very remote, suberect scales. Legs stout, obscure testaceous, the anterior tibia in both sexes armed with a short spine near the apex externally, and acutely bidenticulated in front. Length $1\frac{1}{3}$ line.

This insect is closely related to *Tr. spinimanus,* but is sufficiently distinct, and may be discriminated from that species by having the elytra deeply and distinctly punctate-striate, the alternate interstices, elevated and clothed with suberect scales, and by the spinous appendages at the apex of the tibia being much smaller.

According to Schönherr, *Tr. alternans* is synonymous with *Tr. scaber* (*scabriculus* of Linn.*), but I possess specimens of *Tr. alternans* from Chevrolat and Germar which are beyond all doubt different from *scabriculus* of Linn., and a distinct insect.

Found rather plentifully in the sand-pits near Charlton Church in June and July; Brighton, Arundel, and in other chalky districts, Mr. S. Stevens.

6. *T. spinimanus,* Germ., Steph. secund. ejus descr.

The forms of the thorax and elytra of this insect differ from *Tr. alternans,* but are easier seen than expressed; it may however be distinguished by having the elytra very faintly punctate-striate,

* Syn. Ins. vii. p. 117.

all the interstices flat and broad, and all very sparingly clothed with short, suberect whitish scales, and by the anterior tibia being armed with a long spine near the apex without, and with two diverging spines in front.

According to Schönherr, *Tr. spinimanus* (which is described by Gyllenhal apparently from a native insect*) is synonymous with *Tr. scaber* (*scabriculus* of Linn.†), but my foreign specimens of *Tr. spinimanus* from Germar himself are very different from *scabriculus* of Linn., and very distinct.

Although I have taken many specimens of *Tr. alternans* in different localities, yet I never met with a specimen of *Tr. spinimanus*; it appears to be very rare; specimens in the cabinet of Mr. Waterhouse were found I think near Cromer, Norfolk, and I am indebted to him for a specimen; I have seen specimens in the cabinet of Mr. Stephens.

XXVI.—*Comparison of the Periods of Flowering of certain Plants in the early Spring of* 1846, *in the Botanic Garden of Belfast and the Jardin des Plantes at Paris.* By WILLIAM THOMPSON, Esq. (Belfast).

To the Editors of the Annals of Natural History.

GENTLEMEN,

Although fully sensible that the following very brief communication on a highly interesting subject is almost too trivial for publication in the 'Annals,' I send it forward under the impression that possibly it may be considered worth the little space that it will occupy.

Belfast, Feb. 27, 1847. WM. THOMPSON.

A PAPER by M. Ch. Martins appeared in the number of 'Annales des Sciences Naturelles' for April last, on the subject of the extraordinary temperature of the winter of 1846, and its influence on the flowering of plants. Lists of the species which flowered in the Botanic Garden of Paris at certain periods of that season being given, they suggested to me the desirability of drawing up similar lists respecting the Botanic Garden at Belfast. These compared with the others exhibit some interesting results, although the number of species noted down in the latter locality falls far short of what could be wished. The information respecting them was derived from Mr. D. Ferguson, the able curator of the Garden—who also supplied the few notes respecting Glasgow.

[It was not until after this communication was read before the

* Gyll. Ins. Suec. iv. p. 614.

† Syn. Ins. vii. p. 117.

Meeting of the British Association at Southampton in September last, that I was aware of a paper to the same effect respecting Brussels having been read by M. Quetelet before the Academy of Sciences of that capital, on the 7th of February 1846. A notice of it appeared in the 'L'Institut' Journal of August 12 (No. 658. p. 272). Very few plants are there named, and such in my lists as are of the same species have been noticed in connection with them.]

Plants which flower every winter in the Botanic Garden at Belfast and its neighbourhood.

**Linaria Cymbalaria.*
[1] **Senecio vulgaris.*
†*Arabis alpina.* Not checked by severe weather; flowers when snow is on the ground.
†*Ulex europæus.*
[1] †*Bellis perennis.*
[1] †*Viola tricolor.*
†*Tussilago Petasites* ‡.
[2] †*Cydonia (Pyrus) japonica.*
[2] †*Cynoglossum Omphalodes.*
**Capsella Bursa-pastoris.* Flowers generally in mild winters—flowers four times in the year.
†*Rhododendron dauricum.* Generally flowers about Christmas.
†*Ficaria ranunculoides.* In flower at mid-winter 1845–46; always in flower here mid-February §.

Plants in flower at end of January 1846.

‖*Helleborus fœtidus.* } Not extraordinarily early for them.
‖*Daphne Mezereon.* }
‖*Kerria (Corchorus) japonica.* Always in flower first or second week of February.
Prunus sinensis. Covered with flowers end of January; two or three weeks earlier than usual.
†*Mahonia aquifolium.*
‖*Cornus mas* ¶.
Prunus Lauro-cerasus. Commenced flowering in profusion, end of January.

* Flowering March 20—22 at Fontainbleau.
† Flowering February 28 in Jard. des Plantes, Paris.
[1] In the extraordinary mild winter of 1845–46 did not cease to flower at Brussels.
[2] Commenced flowering from the 20th to the end of January at Brussels.
‡ Flowers about Glasgow commonly at the end of March or by the 1st of April.
§ Sometimes the end of March or 1st of April before it flowers about Glasgow.
‖ Flowering February 18 in Jard. des Plantes, Paris.
¶ Commonly at Glasgow early in February.

Plants in flower at 1st of February 1846.

†*Hepatica triloba.* Generally in flower mid-February.
Saxifraga oppositifolia. Three weeks earlier than usual.
†[—— *crassifolia.* } Always flower in February; not particu-]
[—— *cordifolia.* } larly remarked this year.]
†*Hyoscyamus Scopolia.* Generally flowers 1st of February.
†*Andromeda calyculata.* Generally in full flower 1st of March.

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†*Erica herbacea***. Flowered fully, early in February—two to three weeks earlier than usual.

‖Chinese Roses. Showed flowers in their spring growth end of February—shoots 12 to 18 inches long when cut down by frost on the 18th of March.

Rhododendron arboreum (hybrids of). Commenced flowering about 1st of March.

‖*Syringa vulgaris* (purple and white flowering). Exhibited their spikes, some of which were in flower early in March.

Fuchsia discolor and its varieties partially in flower early in March.

Lonicera tatarica. In full flower early in March.

‖*Primula sinensis.* Not tried out of doors in Belfast Botanic Garden.

When at Springvale, on the eastern coast of the county of Down, on the 26th Feb. 1846, I remarked a horse-chestnut tree (*Æsculus Hippocastanum*) of about thirty years' growth with green woody shoots fully three inches in length on its lower branches, and flower-buds developed to half that extent. The article commented on informs us, that on the 28th Feb. the large horse-chestnut tree ("Marronnier") of the Tuileries, Paris, bore on its under branches a great number of perfect blossom-buds, and the leaves were expanded to the extent of five centimetres; the upper branches were not so far advanced (p. 229).

On the same day at Springvale, the May-flower (*Caltha palustris*) exhibited flower-buds in such a state of forwardness, that another week of such weather would develope the full flower.

Meteorological tables of the temperature of many winters compared with that of 1845–46 at Paris and Brussels are given in the articles referred to; but, in a communication on the whole so brief as the present one, it may be sufficient to notice the few salient points of that winter at Belfast.

Dec. 1845. The temperature of the month of December has frequently of late years exceeded that of 1845.

† Flowering February 28 in Jard. des Plantes, Paris.
‖ Flowering February 18 in Jard. des Plantes, Paris.
** Did not usually flower about Glasgow before the middle of March.

Jan. 1846. The temperature of this month was higher by 3° than that of January in any of the many years referred to.

Feb. 1846. The temperature was as high in February 1827 as in this month, and was within 1° of being as high in 1826 and 1829.

The chief feature of the winter was therefore in the high temperature of the month of January, and again, of that and February combined; the difference between the mean of the two months being less than 1°. A check to the rapidly advancing vegetation was given on the 18th of March, upon the night of which and the following, the thermometer at the Botanic Garden, Belfast, fell to 21° Fahrenheit.

XXVII.—*Notice of a new species of* Dawsonia. By Robert Kaye Greville, LL.D., F.R.S.E., F.L.S. &c.*

[With a Plate.]

No one can take the most cursory glance at the subject of the present notice without being satisfied that it is distinct from the only other described species, *Dawsonia polytrichioides* of Hooker; and yet it is extremely difficult to draw up such a character as shall distinguish it on paper, if we except the much larger size. The latter feature however is so decided, that practically there can be no hesitation in pronouncing between the two species.

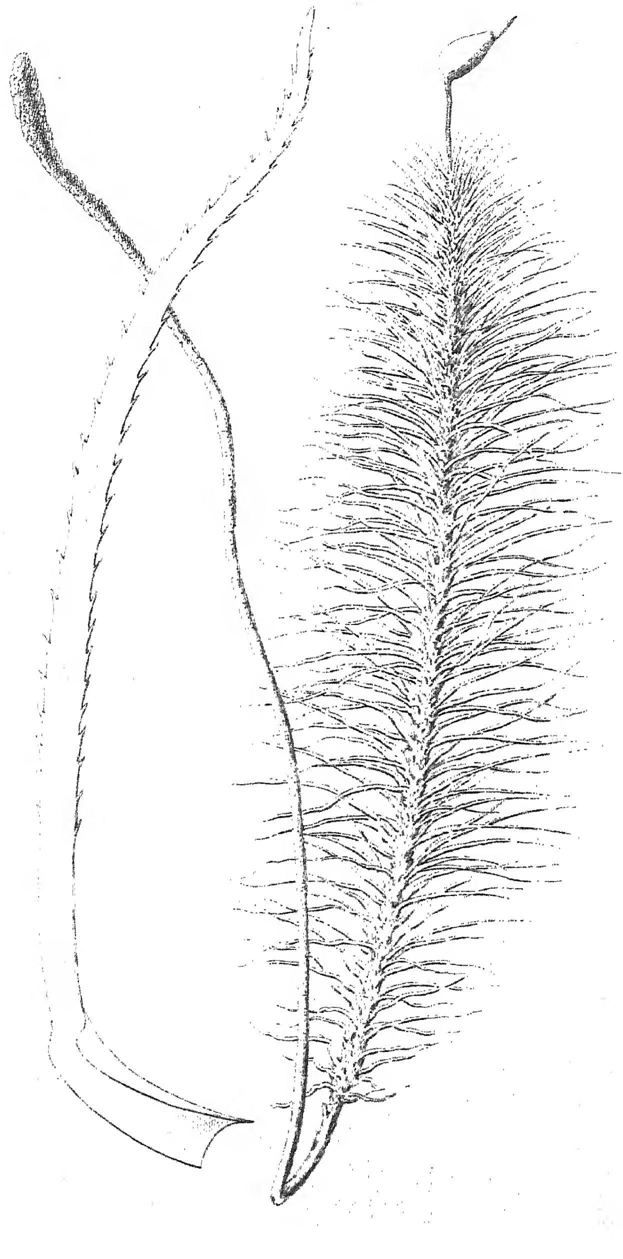
The single specimen which I possess of the new species, which I propose to name *Dawsonia superba*, was sent to me from Australia a few years ago by my friend Augustus Erskine, Esq., Deputy-Assistant Commissary-General in that country.

In the same parcel were some New Zealand plants, but from those with which the *Dawsonia* was associated in the collection, I have little doubt that it, as well as the previously known species, is an Australian plant. My specimen is fully fourteen inches high, whereas the tallest of those of *D. polytrichioides*, as described both by Dr. Robert Brown and Sir W. J. Hooker, do not exceed four inches, including the seta. The *leaves* are an inch in length (nearly three times longer than in *D. polytrichioides*), linear-subulate, less rigid than in the last-named species, and spreading in a more lax manner, spinuloso-dentate, but only toothed at the back of the nerve near the apex. At the lower extremity the very wide membranaceous sheath is of a fine purplish pink colour. *Seta* three-fourths of an inch in length. *Capsule* with the operculum, resembling that of *D. polytrichioides*, but twice as large.

Dawsonia superba; procera, foliis uncialibus, rigidiusculis, sublaxe patentibus. Plate XII.

Hab. Australia.

* Read before the Botanical Society of Edinburgh, March 11, 1847.



XXVIII.—*Notes on some* Chalcidites *and* Cynipites *in the Collection of the* Rev. F. W. Hope. By Francis Walker, F.L.S.

The species in the following list belong to a collection which the Rev. F. W. Hope received from Austria, and kindly allowed me to inspect.

Chalcis emarginata, Fabr.? Brazil = *Chalcis punctata*, Fabr.
—— *conica*, Fabr., Brazil.

Body black, thinly clothed with white hairs: head and thorax punctured: antennæ piceous: abdomen obclavate, smooth, shining, longer than the thorax; the latter segments attenuate; a spiracle visible on each side of the telum: legs yellow; thighs black except their tips; an interrupted and irregular black band around each tibia: wings limpid, not more than half the length of the body; squamulæ yellow; nervures pale brown. Length of the body $3\frac{1}{2}$ lines; of the wings 4 lines.

Chalcis nana, Kollar, Austria = *Chalcis parvula*, De Laporte, Ent. Mag. ii. 32.
Eurytoma aspera, Kollar, Austria = *Eurytoma nodularis*, Boheman.
—— *geniculata*, Kollar, Austria = *Isosoma angustatum*, Walker, Ent. Mag. i. 20.
—— *signata*, Nees, Austria = *Decatoma Cooperi*, Curtis, Brit. Ent. 345 = *D. biguttata*, var.
—— *Neesii*, Kollar, Austria = *Decatoma mellea*, Walker, Ent. Mag. i. 27.
Torymus Vicicellæ, Kollar, Austria = *Monodontomerus dentipes*, ♂?.

Dark bluish green: antennæ dark piceous, shorter than the thorax: abdomen dark cupreous, nearly fusiform, bluish green at the base; metapodeon occupying nearly half the dorsum; octoon very short; ennaton much longer than the octoon; decaton shorter than the ennaton; protelum still shorter; paratelum and telum very short: legs rusty red; thighs mostly bluish green: wings slightly clouded, especially near the stigma; nervures piceous. Length of the body $1\frac{1}{2}$ line; of the wings $2\frac{1}{2}$ lines.

Torymus giganteus, Kollar, Austria.

This seems to be only a large variety of *Megastigmus dorsalis*.

Torymus cyaneus, Kollar, Austria = *Callimome ditto*.

Male and Female.—Bright blue varied with purple and green: antennæ black: sheaths of the oviduct longer than the abdomen: legs pale yellow; thighs blue; hind tibiæ piceous: wings limpid; nervures fulvous. Length of the body $1\frac{1}{4}$—$1\frac{1}{2}$ line; of the wings 2—$2\frac{1}{2}$ lines.

Siphonura trochilus, Kollar, Austria, Istria, Sicily = *Ormyrus tubulosus* (*Cynips tubulosa*, Fonscolombe), Ent. Mag. ii. 161.
—— *cyanosthetus*, Kollar, Austria.

Female.—Bright purple: head bluish green: antennæ black: ab-

domen bright green at the base, brassy at the tip, and having brassy bands across its back, less attenuated than that of *Ormyrus tubulosus*, but more so than that of *O. punctiger*: legs tawny; tarsi paler; thighs bluish green: wings limpid; nervures brown. Length of the body $2\frac{1}{2}$ lines; of the wings $2\frac{1}{2}$ lines.

Eucharis adscendens, Fabr., Austria.
—— *cyniformis*, Latr., Austria.
Perilampus violaceus, Fabr., Austria.
—— *auratus*? Nees, Austria = *Perilampus italicus*, Latr.
Encyrtus scutellaris, Dalman, Austria.
—— *Lecaniorum*, Kollar, Austria = *Encyrtus Swederi*, Dalman.
—— *punctipes*, Dalman, Austria.
—— *Æsculi*, Kollar, Austria = *Encyrtus sericeus*, Dalman.
—— *dasycerus*, Kollar, Austria = *Encyrtus Azalius*, Walker, Ent. Mag. iv. 457.
—— *poduroides*, Kollar, Austria = *Encyrtus mirabilis* (*Cerapterocerus ditto*, Westwood).
—— *erythrosthetus*, Kollar, Austria.

Head transverse, convex, finely punctured, as broad as the thorax, blue below, green in front, æneous above: eyes dark red: antennæ slender, subclavate, as long as the head and the thorax; first joint elliptical, black, much dilated, white at the tip, nearly as long as one-third of the whole antenna; second joint white, slender, linear, black above at the base; third and following joints to the eighth slender and linear, successively but slightly increasing in breadth and decreasing in length; third, fourth and fifth joints pale brown; sixth, seventh and eighth joints white; ninth, tenth and eleventh joints forming a fusiform black club as long as the two preceding joints: thorax æneous green and roughly punctured and clothed with white hairs above, pale orange, smooth and shining beneath and on each side: pectoral plates very large: abdomen short-elliptical, not so long as the thorax, black and flat above, pale orange at the tip and on the under side which is keeled: legs white; tarsi pale yellow; claws brown; middle legs slightly dilated as usual: wings limpid; squamulæ pale orange; nervures brown. Length of the body $\frac{3}{4}$ line; of the wings $1\frac{1}{2}$ line.

It has some resemblance to *Encyrtus sericeus*, but is rather narrower, and its colour and the structure of its antennæ at once distinguish it from that species.

Encyrtus stigma, Kollar, Austria.

Body broad and thick: head dark blue, transverse, short, convex, thinly punctured, purple in front, a little broader than the thorax: antennæ subclavate, slender, as long as the head and the thorax; first joint pale red, long and slender; second and following joints to the sixth rather short, pale brown, slightly hairy and successively decreasing in length; seventh and eighth joints short, white; ninth, tenth and eleventh joints forming a black elliptical club that is longer and broader than the two preceding joints: thorax brassy black,

roughly punctured above; scutellum blue towards the tip: abdomen brassy green, smooth, shining, obconical, flat above, slightly keeled beneath, not longer than the thorax: legs black; tarsi and tips of tibiæ pale red; middle legs having the tibiæ armed with long spines, and the tarsi much dilated: wings limpid; squamulæ pale red; nervures brown. Length of the body $\frac{3}{4}$ line; of the wings $1\frac{1}{2}$ line.

Encyrtus Eitelwienii, Ratzeburg, Austria = *Encyrtus flaminius*, Dalman.
—— *graminis*, Kollar, Austria = *Encyrtus subplanus*, Dalman.
—— *longicornis*, Kollar, Austria.

Female.—Body æneous, long and narrow: head and thorax convex, finely punctured, almost smooth: head transverse, dark green, hardly as broad as the thorax: eyes piceous: antennæ black, filiform, extremely slender, shorter than the body; first joint long and linear: thorax elliptical: prothorax very distinct above, narrower in front: abdomen fusiform, depressed above, keeled beneath, rather narrower and much longer than the body: oviduct pale red, projecting a little beyond the tips of the abdomen: legs long, pale tawny, slightly shaded with piceous: hind thighs brassy black; hind tibiæ dark piceous; tips of the tarsi piceous: wings limpid, of moderate size; squamulæ piceous; nervures brown. Length of the body $1\frac{1}{4}$ line; of the wings $1\frac{3}{4}$ line.

This species is allied to *Encyrtus Imandes* (Ent. Mag. iv. 449), but the latter has a different colour, and is less than half its size.

Encyrtus encopiformis, Kollar, Austria.

Body very broad and thick: head and thorax convex, dark bluish green: head transverse, short, a little broader than the thorax, roughly punctured: eyes dark red: antennæ clavate, slender, dull pale tawny, shaded with piceous, as long as the head and the thorax; first joint long, slender, linear; second and following joints short; club piceous, slightly truncate: thorax slightly punctured: prothorax just visible above: scutum of the mesothorax very short; scutellum with a slight longitudinal impression: abdomen dark brassy green, obconical, depressed above, not longer than the thorax: legs stout, brassy black; tarsi tawny, their tips piceous; middle tarsi much dilated: wings small, piceous, iridescent, thick, as if half coriaceous; nervures piceous; ulna and radius very short; cubitus longer than the ulna; stigma very small. Length of the body $\frac{3}{4}$ line; of the wings 1 line.

This insect is allied to *Eunotus cretaceus* (Ent. Mag. ii. 298), to *Encyrtus* (*Choreius*) *ineptus* (Dalman), and to *Epicopterus choreiformis* (Westwood, Mag. Nat. Hist. v. 418), and it resembles the last species in having a slight indentation on the fore border of the wing near the end of the humerus.

Encyrtus fallax, Kollar, Austria = *Encyrtus hemipterus*, Dalman.
—— *atomon*, Kollar, Austria.

This beautiful little species seems to belong, or to be very nearly allied to, the genus *Tetrastichus*. The body is dark blue and rather

narrow: the head is red: the antennæ are white with black rings, setaceous and as long as the thorax: abdomen fusiform, attenuated towards the tip, longer than the thorax: legs pale yellow; tips of the tarsi black; a broad black band round each thigh: wings limpid, mottled with brown, very deeply fringed like those of *Thysanus* or of *Mymar*; nervures piceous. Length of the body $\frac{1}{2}$ line; of the wings 1 line.

Eulophus amethystinus, Kollar, Austria = *Entedon* (*Derostenus*) *gemmeus*, Westwood.
—— *orbifer*, Kollar, Austria = *Euplectrus* (Westwood) *bicolor* Swederus.
—— *Aceris*, Kollar, Austria = *Eulophus Orsinus*, Mon. Chal. i. 126.
Pteromalus Mesoleptorum, Kollar, Austria = *Pteromalus cavus*, Ent. Mag. ii. 477.
—— *robustus*, Kollar, Austria.

This species is nearly allied to *Pteromalus latus*, 'Ent. Mag.' ii. 481, but it is larger and has longer and paler antennæ. Body æneous, broad and thick: head and thorax closely punctured: head large, broader than the thorax: antennæ tawny, subclavate, rather slender, as long as the thorax; tip of each joint piceous; first joint linear, long and slender; second cup-shaped; third and fourth very minute; fifth much longer; sixth and following to the tenth successively but very slightly decreasing in length; club conical, much longer than the tenth joint: thorax nearly obconical: prothorax short, slightly concave behind: sutures of the parapsides distinct: propodeon large, transverse, not furrowed: podeon very short: abdomen smooth, shining, broader than long, truncated towards the tip, rather narrower than the thorax, and less than half its length; metapodeon large; octoon and following segments very short: legs pale tawny, rather stout; hind thighs except their tips piceous; tarsi and tips of tibiæ of middle and hind legs pale straw-colour: wings limpid, of moderate size; squamulæ piceous; nervures brown; ulna hardly half the length of the humerus; radius as long as the ulna; cubitus much shorter than the radius; stigma small. Length of the body $1\frac{1}{4}$ line; of the wings $2\frac{1}{4}$ lines.

Eulophus Forsteri, Kollar, Austria.

This species seems to be a variety of *Tetrastichus Eurytus* (*Cirrospilus ditto*, Ann. Nat. Hist. ii. 202); its thorax is more overspread with yellow than that of the specimen there described.

Eulophus histrionicus, Kollar, Austria = *Tetrastichus Zeuxo* (*Cirrospilus ditto*, Mon. Chal. i. 194).
—— *Perilithi*, Kollar, Austria = *Eulophus gallarum*, Nees.
—— *signaticollis*, Kollar, Austrian Alps.

This insect, which is a female, belongs to the genus *Tetrastichus*; the oviduct and its sheaths project a little beyond the tip of the abdomen like those of some other species of that genus. It is very dark piceous or almost black; the antennæ are piceous: there are two parallel sutures along the back of the scutellum: the hinder part of

the scutum, the sutures of the parapsides, and the greater part of the paraptera and of the epimera are pale tawny; the sides and tip of the scutellum are also tawny: the abdomen is fusiform, very slender, much longer and narrower than the thorax: the oviduct is bright pale red; its sheaths are piceous, and about one-fourth of the length of the body: the legs are pale tawny: the wings are limpid, and when at rest they do not extend beyond the tip of the abdomen; the nervures are pale tawny. Length of the body $1\frac{3}{4}$ line; of the wings 2 lines.

Platygaster acuminatus, Kollar, Austria = *Pl. Olorus*, Ent. Mag. iii. 255.
—— *siphon*, Forster, Austria = *Pl. elongatus*, Westwood.
Teleas pumilio, Nees, Austria = *Telenomus Turesis*? Ent. Mag. iii. 353.
—— *Dipterorum*, Kollar, Austria = *Telenomus Phylias*, Ent. Mag. iii. 348.
—— *alpinus*, Kollar, Austria = *Telenomus Alcon*? Ent. Mag. iii. 352.
Ibalia cultellator, Latr., Austria.
Cynips Calicis, Hartig, Austria.
—— *Caput Medusæ*, Hartig, Austria.
—— *folii*, Linn., Austria.
—— *lucida*, Kollar, Austria.
—— *tinctoria*, Hartig, Sicily.
—— *Kollarii*, Hartig, Austria.
—— *lignicola*, Hartig, Austria.
—— *Hartigii*, Kollar, Austria.
—— *radicis*, Hartig, Sweden.

All the above species of *Cynips* are females, and are nearly allied to each other, with the exception of *C. folii* which is a male, and may belong to a different group of the family.

Teras terminalis, Hartig, Austria.
—— *spongiparus*, Kollar, Austria.
—— *pedunculata*, Kollar, Italy.
—— *Cerris*, Kollar ("an *Teras*"), Austria.

Of these four species of *Teras*, the first, second and third are common in England, and are perhaps only varieties of one species. The fourth differs from the rest in colour, being all black with tawny antennæ and legs.

Synergus socialis, Kollar, Austria.
Aylax Brandtii, Ratzeburg, Austria.
—— *floricola*, Kollar, Austria.
Synophrus politus, Hartig, Austria.
Psilogaster tibialis, Hartig, Austria.
—— *monilicornis*, Kollar, Austria.
Figites Urticeti, Dahlbom, Sweden.

XXIX.—*The Birds of Calcutta, collected and described by* Carl J. Sundevall*.

[Concluded from p. 173.]

100. *Podiceps philippensis*, Temm. Man. ii. p. 129; et ibid. Analyse, p. cvii; Buff. Pl. Enl. 945.—P. minor, var. β, *Lath.* Fuscescens remigibus cubiti albis; tarso postice duplici serie irregulariter serrato: interne 8—9-dentato; digitis margine undique integerrimo†.

♂ (d. 22 Martii). Iris flava. Corpus dilutius quam *P. minor*; superne cum alis et capillitio rufescenti-fuscum, nucha pallidiore; subtus albidum, collo pallide cinerascente. Remiges primariæ undecim: 2^{da} reliquis longior; omnes fuscæ basi et intus late albæ. Remiges cubiti albæ: mediæ immaculatæ; anticæ et posticæ macula fusca extus, prope apicem, in posticis majore. Tectrices fuscæ. Rostrum majus, sutura recta; forma ut *P. cornuti*. Caput absque crista vel barba. In tarsi margine postico squamulæ seriei *exterioris* circa 23, quarum 17 (sc. 3 et sequ.) serratæ; interioris 18, quarum 9 (sc. 7^a—15^a) serratæ; mediæ utriusque seriei majores, obtusi.—Paullo major quam *P. minor*. Long. $8\frac{3}{4}$ poll. Rostrum e fronte 23 millim., ad fauces 29, altit. $8\frac{1}{2}$, cum cranio 52; ala 97 millim., tarsus 37, dig. med. 40, cum ungue 46.

Alia individua (eodem die; veris. seniores), collo dilute rufo.

Indiv. e Java (coll. Gyllenkr.) obscurius, capite supra et tota nucha nigro-fusca. Occipitis et colli superioris latera castanea. Ala 112 millim., digitus medius 44, cum ungue 50. Cetera ut descr. superior.

The species of the genus *Podiceps* are among the more difficult to define by general characters, as may be seen in the two largest, viz. our *P. cristatus* and *rubricollis*. In the winter dress these can hardly be distinguished but by size, and in fact specimens of the smaller species (*P. rubricollis*) are often met with which are decidedly larger than many of *P. cristatus*. Like water-birds in general, they vary more than land-birds in size and colour. The Indian species just described is very like our *P. minor*, so that they may easily be confounded, even in the summer dress. It occurs not rarely about Calcutta, and was very common at the end of March in the small lakes near Sucsagor. Five or six commonly kept together. They dived with remarkable activity, and when alarmed flew only a short way close over the water, on the surface of which they were often seen to run.

In addition to these birds, which with two exceptions were

* Translated from the 'Physiographiska Sällskapets Tidskrift' by H. E. Strickland, M.A.

† *Pod. minor* remigibus cubiti albis, omnibus extus plaga fusca, posticis fere totis fuscis; tarso postice duplici serie regulariter serrato denticulis æqualibus, interne sub-12. Digitorum membrana serrulata. Rostrum minus.

found within the boundaries of Bengal, I may reasonably enumerate the water-birds which I saw in the Bay of Bengal, and which certainly often come ashore in that country.

101. *Tachypetes aquilus*, Vieill., *Pelecanus*, Linn. Frigate-birds were seen several times in December in the Indian Ocean, between 10° N. and 10° S., but not beyond these limits. There were commonly two or three not far from each other, and in places where flocks of other sea-birds were assembled, but the frigate-birds soared high over these in large circles like the kite, with which it has so much resemblance in the form of tail, size, and mode of flight, that one might easily mistake them. Occasionally the colour of one species (*T. minor*) resembles that of the kite. The wings however are more angular, and the long beak is distinctly visible. The feet are more like those of *rapacious* than of *natatorial* birds, and the membrane is scarcely larger than that found at the base of the toes in most birds of prey. The plumage also has a rather anomalous appearance for a water-bird, especially in the feathered tibia. It constitutes a truly transitional form between the rapacious and natatorial birds. It is often seen to plunge into the water from a great height after the flying-fish, which seem to form its principal food. All the specimens I saw were white below, and seemed to be blackish above. I saw no frigate-birds in the Atlantic Ocean, though they are found there also, and breed abundantly on Ascension Island (see Burton in Linn. Trans. vol. xiii. p. 1). They are stated to lay only a single egg, upon the ground, in September, which is sat upon by the male, who is wholly black; the female, who is white below, procures food. They cannot walk on the ground. (Burton, *l. c.*)

102. *Phaëton melanorhynchus*? Gm., Lath. Small Tropic-birds occur commonly in the Indian Sea, within the torrid zone; but though I certainly saw hundreds, and many of them only twenty or thirty ells distant, I did not succeed in getting any; for if one were to shoot a bird in the open sea, it is commonly impossible to procure it. This species is hardly as big as a pigeon; it seems but little larger than *Sterna hirundo*, and is all white except a black band near the eye and one upon the wing. The tail is rounded, rather shorter than that of a pigeon, with two long white medial feathers, which measured from the root are as long as the rest of the body including the beak. Among the many which I could distinctly observe, not one occurred which had these feathers red, or as long as they are commonly figured and described in Tropic-birds. The beak appeared red and the feet black. The young ones are waved with black or gray on the upper part. In outward appearance and mode of flight it resembles a

tern, but the neck is more extended, and the wings are moved incessantly. It flies constantly, not remarkably quick and somewhat unsteadily, generally at the height of twenty or thirty ells; I never saw any of them repose upon the water. Two or three are often seen together, when they appear to chase one another, and utter a shrill cry like *tjeck, tjeck.* During flight they are wont frequently to turn the head and look behind them, which action is especially characteristic, as one seldom sees it in other birds. They seem to be very inquisitive, and often come near to examine the pennant of the ship. They would fly round it for half an hour, and look at it from every side as though they would bite at it, fly away and return several times, till at last they seemed weary and took themselves off. Occasionally they plunged straight down into the water to catch flying-fish, and on two occasions I distinctly saw them come up again with one in their beak. It occurred to me that Tropic-birds may migrate with the sun, for in my outward voyage across the Indian Ocean from November to January, they were seen as far as 26° S. (on Nov. 7), but on my homeward voyage from May to July they were not seen further south than 7° (July 7). Far up in the Bay of Bengal, till within ten or twelve [Swedish] miles from the land, they were seen at both seasons, though they were rare in January and very abundant in May.

In the Atlantic Ocean I did not see more than two Tropic-birds, and both times at a distance, so that I am not sure what species it was. Several of the crew who had been in Brazil said that they had but seldom seen these birds, and that they are there much larger than those we saw in the Indian Sea. It seems to me highly probable that the small Tropic-bird never occurs in the Atlantic, and the large one but rarely.

103. *Phaëton æthereus,* L. The great Tropic-bird in colour resembles the last, but is twice the size, nearly as large as a tame duck, with a rather longer and thicker neck, and the two feathers in the tail only twice as long as the other rectrices (the part which extends beyond the tail seemed about one quarter the length of the bird). In flight and mode of life it resembled the foregoing species, but was more slow in its motions. I saw it only a few times in the northern part of the Indian Ocean. One was seen in December which wanted the two long tail-feathers.

In the same region, namely in the southern part of the Bay of Bengal, there was seen occasionally in December a bird which I believe was the young *P. æthereus.* It resembled it in size, form, flight and voice, but seemed altogether ash-gray, and wanted the two long tail-feathers*.

* The species here termed *æthereus* appears to be the *P. phœnicurus.*—H. E. S.

104. *Dysporus piscator*, Ill.—Pelec. piscator, *L.*, *Lath.* Sula candida, *Briss.* (adulta). P. sula, *L. et Auct.* (diagnosis e juniori hujus sp., sed synonymia et descriptio sunt alius speciei).

Gula nuda; rostro tenuiore, apice curvato, facie pedibusque rubris; cauda acuta.

Vetus fere totus albus, dorso pure colorato. Remiges et rectrices nigro-fuscæ. Facies, rostrum et pedes corallino-rubra. Ala 360 millim., cubitus 200, cauda 200, cetera ut sequ. *Mediæ ætatis?* albus, dorso toto, alis caudaque fusco-cinereis, plumis sparsis albidis sordidisve. Alarum tectrices præsertim albo-variæ. Pectus ad latera pallide fuscum. Remiges et rectrices obscure fuscescentes. Rostrum apice fuscum. Ala 320 millim., cubitus fere 200, cauda 190, tarsus 30, digitus medius cum ungue 66, rostrum e plica frontis 80, e fauce 110, altit. baseos 27.

Junior pallide fusco-cinerascens, jugulo pectoreque dilutioribus, ventre albido. Corpus superne, præsertim in alis, plumis albidis et obscuris maculatum. Facies et pedes sordide rubicundi.

Vix duo colore perfecte similes invenies. Etiam dimensiones paullo variabiles. Rostrum e basi sensim angustatum, apice sutura sat curvata. Facies late nuda, limite plumata non ad fauces angulata, sed gulam nudam circulariter ambiente. Rectrices 2½ poll. excedunt alas; minus rigidæ, mediæ apice acutæ.

The species of *Dysporus* are much like each other, and remarkably distinguished from other allied forms. The genus *Phaëton* approaches them the nearest. They are sea-birds which only approach cliffy sterile shores to breed, but which are otherwise chiefly seen far from the land, often in the midst of the ocean, in regions where the water is not very deep, as on banks of 20 to 100 fathoms, where they have access to fish and crustacea. They fly almost incessantly, but heavily, with their somewhat long neck stretched out, in a straight line but not rapidly, and flap their wings considerably, by which they are easily distinguished from albatroses and petrels, which have a remarkably smooth flight, with the outstretched wings almost motionless. The Gannets which I saw, frequently look behind them during flight like the Tropic-birds.

D. piscator is very common in the Indian Ocean, between 10° N. and 10° S. I have but seldom seen it beyond these limits, and never near the Cape or in the Atlantic, where other species occur. I saw one in May as far up as the Bengal coast. Gray, white, or spotted individuals are found mixed together at all seasons, at least such was the case when I crossed the region where they occur. In November and December they were seen in flocks; in June and July they were solitary or in pairs. The food consists of fish, which they catch by plunging. They commonly fly eight or ten ells above the sea. Like *Sterna stolida* this species is known by its stupidity, and by the boldness with which they

would light towards evening upon the vessel. On two occasions I nearly caught them with my hands. The English, and seamen in general, call them Boobies*.

* The species of this genus known to me are the following:—

1. *Dysporus bassanus*, Ill. *Pelecanus bassanus*, L. *Sula alba* et *S. bassana* recentiorum. Gula plumata, linea media nuda. Genæ quoque plumatæ limes faciei ad os angulatus, &c. Reliquis major. In Mari Atlantico Septentrionali.

2. *D. capensis*, Licht. Berl. Verz. p. 86. "Albus remigibus *omnibus* et rectricibus nigris, scapis basi albis. *D. bassano* paulo minor, 34 poll." (*i. e.* 36 poll. Suec.) Gula, ... Facies, ...

This species is seen at all seasons on the great banks off the south extremity of Africa. It is easily known from the following by its greater size and more stretched-out form; it also moves its wings more during flight, instead of occasionally holding them still. I have only seen this bird at a distance, and always (in October and August) of a pure white and black.

3. *D. cyanops*, n. (Physiogr. Tidskr. pl. 5). Gula genisque nudis, facieque cæruleis, cauda rotundata.

♀ (ad æquatorem maris Atlant. d. 6 Sept.). Alba; dorsum et colli latera plumis nonnullis fuscis. Alarum tectrices minores albæ, immixtis aliis fuscis; majores omnes nigro-fuscæ. Remiges *omnes* nigro-fuscæ, basi intusque albæ. Rectrices fuscæ basi albidæ. Iris flavissima. Facies et rostrum ultra medium cærulea; apex olivaceus. Pedes olivacei membrana fusca. Long. 30 poll. Sv., ala 420 millim., rostrum e fronte 100, cauda 170, tarsus 52, digitus medius 70, cum ungue 82. (Alæ extensæ 5 ped. 3 poll., truncus 10 poll., latit. 5, altit. 4.)

Junior? (eodem loco et tempore anni). Differt magnitudine paullo minore, rostro ex apice fere ad basin olivaceo, dorso toto fusco, alis magis fuscis, collo et capite totis sordide albis, nec fusco-maculatis.

Adultus albus, remigibus caudaque nigris (tantum procul visus).

Pullus? fere totus cinereo-fuscus, ... do.

Limes faciei ut in *D. piscatore*, sed pone oculos non sinuatus. Rostrum crassius, fere 4-gono pyramidale, apice leviter deflexo. Ala ad ⅓ excedit anum. Cauda submollis, alam perparum (1 poll.) superat.

Anatomia feminæ supra descriptæ. Œsophagus maxime extensilis. Ventriculus magnus, oblongus, sacciformis, fere cutaneus, strato musculari obsoleto. Pars glandulosa nulla constrictione distincta, fere dimidiam partem superiorem ventriculi constituens; glandulæ cylindricæ, altit. 3 millim., in tres areas, lineis angustis lævibus distinctas, congestæ, limite undique definito. *Intestinum* totum longit. 80 poll. exit e latere apicis ventriculi; duodenum longissimum: 20 poll. ad insertionem ductus hepatici. Int. cæca 2 parva, 3 poll. ab ano sita. Cloaca interne sat glandulosa. *Hepar* magnum, substantia molli, lobis fere separatis, elongatis; sinistro 1 poll. pone apicem sterni extenso, 2 poll. breviore quam dextro.—Vesica fellea ut in plerisque natatoribus. *Pancreas* e laciniis duabus omnino separatis, linearibus, exitu cum hepatis communi. *Cor* simile *Alcæ* et *Uriæ*.—*Musculi* et *nervi* evidentissimi ob pinguedinem vix ullam. *Sternum* longum carina humili. *Collum* angulis duobus definitis ut Z flexile. *Cranium* postice strictura profunda.

This species occurs in the Atlantic Ocean near the equator. I have not seen it elsewhere, but when I crossed this region (on both occasions in September) it occurred in considerable plenty. In this part of the ocean no banks are marked in the charts, though I suspect that the depth is in some places not great (perhaps not more than 50 or 100 fathoms), both from the occurrence of these birds in that region, and from the sea wanting the clear-

105. *Sterna stolida*, L. Genus *Megalopterus*, Boie. Nigro-fusca fronte canescente, loris atris, cauda rotundata. Longitudo alæ circa 250 mill.; rostrum variat: 35—50 mill. (e fronte).

Junior magis grisescens; adulta nigrior, fronte albidiore. Differt a *Sternis* propriis: forma caudæ, colore, collo longiore, et humero cubitoque ut in *Procellaridibus* longitudine trunci, unde volatus alius. Unguis medius in quibusdam, minime specifice distinctis, intus serratus (an differentia sexus? in uno ♂ observatum).

This bird, common in all collections, is one of the most widely extended species: I have found it very common in all the Indian Ocean, and in the Atlantic as far north as Madeira, though less frequent than on the other side of Africa. Like all the truly oceanic birds it was most abundant towards the south, and was seen in great numbers about 39° S. in October. According to the observations of others, it occurs still further to the south in the Pacific Ocean. At night they settled occasionally on the vessel, and could sometimes be captured by hand. One evening after dark a noddy settled on the steersman's head and was caught by him. This occurred the 7th of September near the equator in the Atlantic, and as it was the only one which I procured on that side of Africa, it served for comparison with those of the Indian Ocean: they are of the same species. I have only seen

ness and bright blue colour which prevail in great depths of ocean. This *Dysporus* moves the wings during flight eight or ten times in succession, and then sails forwards a short distance with the wings still; but it cannot, any more than the other species which I have seen, soar round in majestic circles like the petrels and frigate-birds. The same seems to be the case with *D. bassanus*, though it flies somewhat more lightly and considerably higher than the southern species. Like *Phaëton* and the other *Dyspori* this bird plunges and dives some distance under water, and then suddenly flies up again without running on the surface. Those which were opened had eaten flying-fish, and one had four of these fish the size of a common herring, besides a crab, in its stomach. Like all sea-birds they had a remarkable number of tapeworms in the intestines. The flesh was oily and tough. This as well as the Indian species showed much curiosity, though they did not fly around the pennant, which is too high for them, but kept astern of the vessel and peered down on to the deck without attempting to settle.

4. *D. piscator*, vide supra, No. 104. In Mari Indico et Sinensi.

5. *D. fuscus*. *Sula fusca*, Vieill. Gal. *Pelecanus sula*, L., Lath., secundum synonymiam et descr. sed diagnosis a *D. piscatore* desumta. Catesby 87. fig. opt.—Gula nuda, facie pedibusque flavescentibus, rostro basi convexo-incrassato, apice subrecto. Cauda rigida, acutissima, 4 poll. ultra alas. Color obscure nigro-rufescens, in adultis ventre albo. Ala 400 millim., cauda 220, rostrum e fronte 98. Hab. in Oceano Atlantico, ad Americam, intra zonam torridam. (Junior subtus quoque fuscus, Licht.) Conf. Pr. Max. Beytr. iv. p. 890.

6. *D. parvus*, Ill. (secundum Kuhl in expl. tab. Daubent. et Buff. 973.) *Pelecanus parvus*, Lath. "Niger subtus albus, facie plumosa; 18 poll. Cayenne." *Lath.*

7. *D. fiber*. *Pel. fiber*, L., Lath. Ut præcedens mihi ignotus. An junior *D. piscator*? sed differre videtur "dorso postice albo."

this species and *Dysporus piscator* settle on the ship, and that only after sunset, when the water was calm and the motion of the ship steady and gentle. It is an entirely unfounded assertion that sea-birds seek ships during storms and tempests, although they keep on the wing at such times, as they cannot repose on the water, and are consequently most conspicuous; moreover they often follow in the wake of the ship, as it affords them a smooth surface. Out of thousands of petrels I never saw one attempt to alight on the vessel, though they have occasionally flown close past, and been cast by the violent eddy of the sail upon the deck, where they were unable either to stand or to fly up again.

Sterna stolida is in its mode of life very unlike the true *Sternæ* with forked tails. These are coast birds, which seldom or never are seen far from land, fly high and unsteadily, live on fish, which they catch by plunging, and scream almost incessantly. *S. stolida* on the contrary is rarely seen near the land, but chiefly far out in the wide ocean; it flies low, steady and slow, leaps upon the water when it flies up, never utters any sound, and never takes its food without settling by the side of its prey upon the water. It lives not on fish but on small mollusca, &c., and is very greedy of the fat of animals. In a word, its mode of life is identical with that of the larger petrels and albatroses; they are strictly oceanic birds. But *S. stolida* can stand or walk on a level surface, which the others cannot, and it consequently alights on the vessel, which they never do.

106. *Haladroma urinatrix*? Ill.—Proc. urinatrix, *Forst.*, *Gm.*, *Lath.* Certe = *Puffinuria Garnoti* e Chili, Lesson (Zool. it. Duperr. et Traité d'Orn.) sec. indiv. e Chili in Mus. Stockh. Forte eadem ac *H. Berardi* Temm. Pl. Col. 517?

In the southern parts of the Bay of Bengal I saw several times in December and January a bird which could hardly be anything else than the above-mentioned. The colour and form were clearly distinguished through the telescope at less than 100 ells distance. It was blackish gray, beneath and under the wings white, with projecting nostrils, and was but little larger than *Alca alle*, L., which it resembled in its exterior. Two or three were commonly seen together resting on the water, from which they occasionally arose and flapped with their wings like ducks. They dived remarkably well and long, like *Alca* and *Uria*, and flew heavily with a rapid motion of the wings for a short distance close over the surface.

Haladroma, from its projecting nostrils, has been included among the *Procellariæ*, but erroneously, for in all other respects it resembles an *Alca*, and differs from the former in its small wings and the want of a hind claw.

107. There now remains only a species of bird which I saw in the Bay of Bengal, but which I know not to what genus it belongs. It was full as large as the small tropic-bird, which it most resembled; it was ash-gray even on the whole under side; the wings below of the same colour, with a small transverse white line (formed by the tips of the lower covers). The wings and mode of flight are nearly like those of the small tropic-bird, but it seemed not to belong to that species, and it showed less curiosity. Two were first seen (Oct. 30) about 37° S. in the Indian Sea, one of which had the two middle tail-feathers rather longer than the rest. This was not noticed in other individuals, which on several occasions were met with in December and January, north of the equator. At the head of the bay, only ten or twelve miles from the Bengal coast, two flocks of these birds were seen, but on my return (from May to July) they were not met with.

Postscript.

In concluding this translation of M. Sundevall's memoir, it is just to that distinguished Swedish zoologist to state, that this paper was published as long ago as 1837, which will account for occasional inaccuracies of synonymy and of classification which the subsequent progress of science has rectified. I thought it better however to republish the paper unaltered, so as to place on record in an English periodical the priority of M. Sundevall's claim to the names which he has given to certain new species, and also to show the many accurate and original observations which he made during his short stay in India. In regard to the *translation*, a few errors have inadvertently crept in which I shall point out in the following notes. It is to be regretted that so few facilities exist in this country for the study of the Scandinavian languages, which are beautifully simple in construction, while they abound in scientific and literary treasures, and exhibit many interesting points of affinity to our own.

Vol. xviii. p. 104, line 23, *for* "I did not expect to find," *read* "I did not find," &c.

P. 108, line 6, *for* "It sang," *read* "It was said to sing."

P. 252. In a letter to me Prof. Sundevall remarks of his *Acanthiza arrogans*, "This bird is the same as *Muscicapa bilineata*, Lesson, Rev. Zool. 1839, p. 104, and *Sylvia Burkii*, Burton, *Culicipeta Burkii*, Blyth."

P. 253, line 30, *for* "Three of the males," *read* "Three of the females."

P. 253, line 38, *for* "only on his second visit," *read* "died on his second visit thither."

P. 255, line 4, *for* "the edges of the under mandible being rather high, and towards the end very much bent in," *read* "which have the

edges of the under mandible rather high, and in the hind part very much bent in."

P. 257, line 34, *for* "Notes, habits, &c. not thoroughly known," *read* "The notes, habits, &c. were completely recognised."

This supposed variety of *Motacilla alba* is the *M. luzoniensis*, Scop. (*M. leucopsis*, Gould, *M. alboides*, Hodgs.)

No. 25. "*Motacilla flava*" is the *Budytes viridis* (Gm.), (*B. beema*, Sykes).

P. 260, line 34, *for* "The best are of compact coarse hay," *read* "They consist of compact coarse hay."

P. 260, last line, *for* "this seemed the most probable," *read* "were most frequently seen."

H. E. Strickland.

XXX.—*On the Development of the* Lycopodiaceæ. By Karl Müller*.

[With five Plates.]

[Continued from p. 120.]

3. *The antheridium.*—*a. The formation of the sporangium.* This sporangium has a more simple structure than the oophoridium. It is found, almost universally, under a more or less reniform shape, having at the base a stalk, which is always longer than that of the oophoridium (Pl. V. fig. 9). The membrane is made up of cells almost regularly hexagonal, a structure which is very various in different species. In *L. denticulatum* it dehisces transversely over the vertex when ripe; but this condition is also subject to modification according to the species. In the interior is then found a free pulverulent mass, the well-known so-called *Semen Lycopodii*. As usual, they are tetrahedral cells which only differ in respect to size and nature of surface. In *L. denticulatum* the surface is covered by a number of papillæ which are broad at the base and, diminishing to a point above, are usually somewhat curved (Pl. V. fig. 1). Seen in any quantity, these spore-cells usually appear yellow: this is the case in *L. denticulatum*: in *L. pygmæum* and other species they appear reddish.

These antheridia are produced in considerable numbers on the other branch, opposite to that which is transformed into the oophoridium (Pl. IV. fig. 6). It is thus evident *a priori*, that the antheridia cannot be regarded, like the oophoridium, as metamorphosed terminal buds of a branch.

* From the 'Botanische Zeitung,' Sept. 25, 1846. Translated by Arthur Henfrey, F.L.S. &c.

To trace its origin, we must, as in every case, turn to the terminal bud. It is a cone more attenuated above than below, originally almost transparent, but subsequently becoming opake through the penetration of water into its internal cavities and substance. This of course occurs through the water applied in the microscopic examination. On this terminal bud, above the youngest leaf and antheridium, at four alternating points around the axis of the branch, two little conical processes are always visible, lying in one plane, *i. e.* one above the other (Pl. V. figs. 2—6, *a b*): they are the youngest parts of the spike, in their earliest condition. The upper process is destined to become a leaf, the lower an antheridium, and both of them are mere processes budding from the axis of the branch. It soon becomes evident that the leaf is increasing in size and exceeding the antheridium in regard to extent of surface, becoming wider at the base and elongated at the apex (figs. 2—6 *b*). This is very natural, since the growth of the antheridium is centralized in its interior, while that of the leaf is more especially directed toward the periphery. The conical process from which the antheridium is to be developed therefore becomes gradually more rounded in its form, and soon appears as a perfect sphere, seated in the axil of the leaf. In this condition both leaflet and antheridium are almost perfectly transparent, like what has been already said of the terminal bud. At a later period however a granular matter makes its appearance, which is seen through the outer and as yet tolerably hyaline membrane of the antheridium, which evidently consists of a layer of denser cells, the granular mass of the antheridium not extending to its external surface (fig. 7). The base of the spherical antheridium is even now tolerably thick, and as it elongates it becomes still more independent (fig. 8). The growth of the antheridium is now particularly directed from the base toward the two sides (fig. 10 *c*). Thus the upper part becomes the more slender, the lower broader, and the form of the antheridium is perfected. It is ovato-reniform, and the peduncle at this time is very slender: this latter often attains a considerable length.

We are now met by the question: What is the import of the antheridium? The reply to this question is somewhat more difficult than to that respecting the oophoridium; yet this much is certain, that the antheridium can be no product from a leaf, since it is formed from the axis contemporaneously with the leaf. As little can we regard it, with Bischoff, as formed by the growing together of leaves. Besides, H. von Mohl has already triumphantly refuted this view. But that we have to do with a metamorphosed bud, on the contrary, cannot be disputed; since the first, rounded antheridium-spherule possesses all the pecu-

liarities of a bud, the epidermis and a formative cell-contents. The only question here is, whether we are to regard this bud as that of a branch, or altogether as an axillary bud like those so often met with in the axils of the leaves. I consider it the *bud of a twig* (*Zweig*), which is only distinguished from the terminal bud of the branch developed into the oophoridium by the circumstance that the latter is a principal branch, which possibly was capable of a more extensive development into branch and foliaceous organs, while the twig which is developed into an antheridium is but a small particle of such a main branch. That it is a twig, appears to me to be shown by the internal structure of the fruit-axis, since from its central vascular bundle are given off real lateral branches to each bud (antheridia). Yet it must be freely admitted, that the vascular bundle does not actually run into the peduncle of the antheridium, but terminates before reaching it, and it is merely elongated cellular tissue which proceeds from the vascular bundle into the peduncle (Pl. IV. fig. 14).

If now we endeavour to bring Von Mohl's observations into agreement with the foregoing facts, we are first opposed by the statement that the sporangia are not actually situated in the axils of the leaves. That is subsequently seen to be perfectly correct, but does not testify against the formation of the antheridium from a twig, since the simultaneously-formed antheridia and leaves also *simultaneously* diverge from the fruit-axis, and thus it happens that if a leaf be cautiously detached from the axis, the antheridium also is removed with it, and may then always be observed on the inwardly thickened base of the leaf. We have, therefore, here an actual growing together of the fruit-stalk and the leaf; and if Von Mohl reminds us that the shortness of the fruit-stalk and the absence of it speak to the contrary in *Isoëtes*, we have here on the other hand a fruit-stalk of tolerable length, and it appears rather that *Isoëtes* possesses a different structure. It would be some what different with *Psilotum* if the antheridium were actually formed from the leaf. I have therefore examined this genus in a living state, and found that the condition is exactly the same as in *L. denticulatum*: the earliest development of the antheridia shows their perfect independence of the leaf, and it is only subsequently that the fruit-stalk contracts such union with the leaf that its exceeding shortness causes it to be scarcely noticed. Yet it may always be recognised as independent if we trace the internal structure of the base of the sporangium in a delicate longitudinal section. Here a thick vascular bundle most distinctly proceeds to an internal, chambered cavity, and the length of the fruit-stalk must consequently be defined by the point where the bundle ends (Pl. V. figs. 9—10). The vascular bundle, closely examined, consists of porous vessels, like

that which proceeds into the leaf. That the sporangium of *Psilotum* however is chambered, is not to be explained, as Von Mohl believes, as resulting from a growing together of several sporangia, but by the fact that—as the course of development shows—the sporangium is always simple in the youngest stage, and the several partitions are formed in its interior subsequently, the number often amounting to four. The partitions are formed of parenchymatous cellular tissue, which ramifies in the interior and consists of enlarged cells. These facts I have observed with the greatest certainty, although I cannot declare the law by which the ramification of these layers of cells is governed, and why their cells do not rather become mother-cells for the spores. That the fruit of *Psilotum* is one-, two-, three- or four-chambered, indicates, from what has already been said of it, that a growing together of leaves or sporangia is not to be thought of here. The inconstancy is too great to admit of our believing, that several sporangia can be developed freely in one axil and so grow together. Here in *Psilotum* however it would be more pardonable than in any other case, to explain the formation of the sporangium by the growing together of carpels, since in a tolerably perfect sporangium a pretty distinct furrow runs over each globular protuberance (*Hügel*), which may easily lead an observer to suppose that it is formed of leaves grown together. In this genus indeed a complete history of the development might become in the highest degree interesting. The structure of the antheridium appears to me to be still more clearly evident in *Tmesipteris* than in *Psilotum*, at least from the dried specimens I was able to examine in the Royal Herbarium at Schöneberg near Berlin; for in these the fruit-stalk was often developed to a considerable length and projected beyond the leaf. In fact, we have here as in *Psilotum* a simultaneous formation of sporangia and leaves, so that it is impossible that the former can be composed of the latter, as in such case the sporangia must clearly be formed subsequently.

H. von Mohl also opposes to Bischoff's view, the formation of the spores in the same manner as pollen-grains, &c., which I have already refered to. This cannot be made to contradict my opinion—in fact, it even does not once touch Bischoff's. For wheresoever formative substance is present, there cells may be formed. These formed, and a sufficient quantity of the formative matter still present, new cells again may be formed within the first, the mother-cells, and the second generation become perfect simple cells which we then call spores.

Regarding Von Mohl's and Bischoff's opinions therefore, I hope that I have succeeded in displaying in a convincing manner, a different theory of the course of development of the antheridia. As to Schleiden's so very definitely stated views, how-

ever, I can oppose no further reasons to them, since this observer has not unfolded his ideas sufficiently in detail. Meantime the figure of the antheridium of *L. annotinum* which he gives in the second edition of his work is represented in such an advanced state, that it cannot by any means be regarded as a proof of the origin of the antheridium from the leaf. Since the leaf and the antheridium are formed simultaneously, it is naturally the earliest stage alone which can yield evidence in the history of the formation of the two organs.

But by this history of the mode of formation, moreover, the independence of the family of *Lycopodia* is shown most indubitably, and the gap which formerly existed between them and the Ferns is again established (compare Röper in the 'Flora Mecklenburgs.,' 1 Th., 1843, p. 127). More of this however hereafter.

b. The formation of the spores. That which is now perfected in the interior of the antheridium is the so-called spore. The essential points relating to its form have already been given in the commencement of these observations on the development of the antheridia. I pass therefore to the history of their development.

According to H. von Mohl the spores are formed here exactly in the same manner as pollen-grains, and this has already been pointed out above in that observer's own words. From my own researches I can of course confirm that here also the spores are formed in mother-cells; meanwhile I have not attained to a complete history of the development in *L. denticulatum*, because in fact I neglected it. The reason however was this: I wished to give a perfect history of the formation in a Lycopodiaceous plant with very large spores; thus to make certain at once, in what peculiar manner the contents of the mother-cells become divided into four parts—whether this, as some observers hold, occurs through division by means of septa, or whether, as others will have it, it is effected through the agency of cytoblasts. To this end I traced the formation of the spores in *Psilotum triquetrum*, which I obtained in a living state through the kindness of Prof. Kunze of Leipzic. In the first place, however, two words on the internal structure of the antheridium of *L. denticulatum*. If once successful, after many long preparations, in obtaining a very fine longitudinal section of the antheridium in a very young condition, we notice a threefold layer in its internal cavity (Pl. V. fig. 11). First the outermost or true epidermis: this is composed of a layer of parenchyma of some density which passes off to the fruit-stalk. To this follows a second layer of empty, transparent and *delicate* parenchymatous cells: this is continuous with the elongated cells in the fruit-stalk. Then comes the third layer which

occupies the whole of the interior: this also consists of delicate parenchymatous cells, which are very densely filled with a formative matter (reddish cytoblastema): they are the mother-cells of the spores. By the examination of the interior we now understand, why the layer of mother-cells of the spores is often compressed in an evident degree, and why, when seen through the young and delicate membrane of the antheridium, they appear globular. The greater or less degree of compression depends of course on the thickness of the epidermis and the subjacent cellular layer.

Passing to *Psilotum*, we find, in a delicate longitudinal section of the sporangium, the same layer of mother-cells which we meet with in *L. denticulatum* (Pl. V. fig. 12). However, the layer of empty cells which follow close upon the epidermis of *L. denticulatum* does not exist here. The mother-cells, tolerably regular in form and of large size, lie closely upon the very thick epidermis of the sporangium of *Psilotum*; they are also distended by a reddish mass, which, agglomerated into a spherical form, may clearly enough be perceived to consist of cytoblasts. If the cytoblast has been cut through a little out of the centre, the central nucleus also is perceived in its granular, distinctly evident substance. These mother-cells are therefore formed through cytoblasts in the first instance, and fill the interior of the sporangium as a large-celled parenchymatous tissue.

The sporangium now swells, and this process depends on the expanding mother-cells (fig. 13). This swelling out and extension act in such a manner that the membranes of the mother-cells acquire an extraordinary degree of transparency, which may be so increased in later stages, that unless one has very sharp eyes and observes with great attention, the cell-walls will be certainly overlooked. I shall return once more to this. The expansion of the mother-cells is combined simultaneously with that of the cytoblasts contained in their interior: this is in consequence of their outer borders becoming dissolved or rather macerated in water, since the softened mass is almost always granular. The latter thus becomes mucilaginous. The cytoblast becomes gradually smaller, but is usually so equably dissolved that it always appears globular (fig. 13). Sometimes however it is oval (fig. 14): this only occurs if the mother-cells no longer lie, as in the former case (fig. 13), one upon another as tumefied cellular tissue, but when the individual cells have become perfectly separated from each other, and thus lie so much freer in the interior of the sporangium. That the sporangium undergoes proportional expansion with the actual enlargement of the mother-cells is to be understood in all cases.

The expansion of the mother-cells proceeds with continually

accelerating rapidity, and with it that part of the cytoblast also becomes more fluid which in the foregoing stages was becoming softened at the periphery (fig. 15). Now it appears as a mass composed of very small granules in a state of fine division in a mucilaginous fluid. The end of the next stage is, that the whole cytoblast has become dissolved in the said fluid (Pl. V. figs. 16, 17, and Pl. VI. fig. 1). It very seldom happens, however, that the mass becomes so fluid that granular points are no longer perceptible in it (Pl. VI. fig. 1).

In the same figure we see, moreover, that the whole mass has become more agglomerated. That is a further stage, and is always met with before the division of the cell-contents into several portions. The whole mass has returned into the condition of cytoblastema*. Thereupon it becomes retracted either on to the walls of the cell, or, as more rarely happens, into the centre.

The mass is now seen to be collected into four parts (fig. 2). Thereby either the whole substance is appropriated, or the four portions are formed inside the mass. This is easily explicable. Each of the portions is a cytoblast: it increases in size in the latter case, because that portion of the mass which has not been appropriated in the formation of cytoblasts becomes deposited upon its external surface (Pl. VI. figs. 3—6).

The substance of the cytoblast is still visibly very mucilaginous. In the interior of it is seen the central nucleus as a simple granule (*Kern*). Around it the mass of cytoblastema is so deposited that its outer contour is composed of granules lying heaped together, *i. e.* very closely applied upon one another (fig. 6).

In a more advanced stage the cytoblast exhibits an enveloping membrane (*Haut*) which is as yet very delicate and mucilaginous (fig. 8). It is now manifestly undergoing extension, and the cell-membranes approach toward each other with increasing pace for the tetrahedral junction† (figs. 6—11).

In fig. 8 *a*, *b*, *c*, we find also how the membrane is formed and extends from the cytoblast on one side only, therefore in the same manner which Schleiden first described. Subsequently however the membrane is detached and expands all round the cytoblast (figs. 9—10 *b*). Frequently it becomes detached at an earlier period, as in figs. 11 and 12.

* Cytoblastema and protoplasma (incl. mucilage, *Schleim*) are essentially one and the same; yet both names may be used, the latter for the oleaginously fluid, mucilaginous mass, the former for the granular and coagulated.

† This is well-known as an expression proposed by H. von Mohl for that position of the secondary cells where their faces, directed toward the centre of the mother-cell, become pyramidally pointed through their reverse superposition, while the outer faces remain spherical.

The whole of the contents of the mother-cell being now appropriated in the formation of the secondary cells and the membrane of the latter quite complete, without their form being as yet necessarily perfected, the mother-cells expand in an extraordinary degree, and the secondary cells become more widely separated (fig. 12). It is worthy of remark here that the secondary cells are usually quite free, rarely (as in fig. 12) occurring on the wall of the mother-cell. There are no signs of their being retained in their position by filaments or similar means of attachment; we must therefore attribute all to the contents of the mother-cell, and assume that the same is of sufficient specific gravity and thickness to maintain this position. I say we must assume it, since in reality it is not to be observed, for no contents can be made evident in the mother-cells even when the strongest tincture of iodine is applied. This is also always the case with the membrane of the mother-cell: this may equally be treated with the most concentrated tincture of iodine, and it remains transparent and so clear, that, as I have already remarked, it is only to be traced by the closest attention. When one of these mother-cells is beheld for the first time beneath the microscope, the appearance has something very striking about it, since the four cells are always seen in one and the same position without the mother-cell being at all perceived. This definite position of the secondary cells is retained even when the mother-cells are moved backward and forward in the water under the microscope. The separation of the secondary cells from each other is however very variable in regard to distance.

Now commences a new process in the history of the formation of the secondary cells, relating to their form. They do not, like the spores of other *Lycopodiaceæ*, remain tetrahedro-spherical, but become elongated (Pl. VI. fig. 13) and form *bean-shaped* cells. On the ventral surface, *i. e.* on the side of the tetrahedral junction, occurs a double border (*Leiste*) in a straight line, whence it appears as though the interior of the cell was open (figs. 15—25). The border however does not extend the whole length of the cell, but at most ⅔rds or ¾ths of it.

This mode of formation of the spores is so much the more striking, that it is in Ferns alone, for instance in *Polypodium Dryopteris*, that we find anything exactly corresponding. At the same time it appears to me, that it already entitles us to give the *Lycopodiaceæ* a higher place than, for instance, Schleiden is inclined to do, who rather places them (Grundzüge, ed. 1. part ii. 80) in the vicinity of Mosses and *Hepaticæ*. However, as I have said, more on this matter hereafter.

The bean-shaped cells lie for some little time in the mother-cell, only, repeating the former condition, they soon become

more (fig. 14) or less (fig. 13 *b*) grouped together. At a subsequent period the absorption of the membrane of the mother-cell takes place.

The outer membrane of the bean-shaped secondary cells is exceedingly delicate and transparent, almost as clear as glass, and thus they produce a very pleasant impression on the eye. The contents consist at present of the cytoblast: this now undergoes a new series of essential changes, into which I will therefore enter more minutely.

It either lies upon the wall, or attached upon a mucilaginous mass more in the centre of the cell (fig. 17). The other characters of position are also excessively variable; sometimes it is in the midst of the cell, sometimes more approached toward the end or in the end itself (figs. 15—20). In the stages where the membrane of the mother-cells is undergoing absorption and the secondary cells come to lie free in the sporangium, the cytoblast becomes altered. Its substance is dissolved, and this usually occurs in such a way that its external border remains behind appearing like a mucilaginous membrane (figs. 18—20). The cytoblast often disappears altogether (figs. 21 and 22).

The mucilaginous fluid originating from the solution of the greater part of the cytoblast passes now into a new structure. It becomes deposited in the shape of exceedingly delicate, minute globules, again coagulated, round the whole internal periphery of the bean-shaped secondary cell or spore, and appears like a very fine precipitate giving the spore a grayish-coloured aspect, produced by the shades the single globules cast around them, whereby of course a peculiar mingling of dark and bright points is necessarily brought about. The outline of the cytoblast is often still to be observed, usually in a roundish form (fig. 23). Before long, the granular contents swell into larger globules which are more or less closely assembled together (figs. 24 and 25). If, in this condition, the membrane of the spore is cut through, a most distinct conviction may be obtained that the remaining space is empty, and that it is from the granular cell-contents alone that the larger globules have originated. At the same time it is seen that the spore-membrane is simple and apparently tolerably tough.

Lastly, the termination of the whole formation is a contraction and corrugation of the hard spore-membrane. It also tears in places, and now occurs a very remarkable phænomenon. The globules (Pl. VI. fig. 26), which, when treated with very concentrated tincture of iodine, appear distinctly hollow (fig. 27) and more or less round, begin to elongate into thick filaments (fig. 28). These frequently branch in the most manifold curves with thick prolongations, and thus usually grow through the

corrugated and torn spore-membrane. I have not succeeded in discovering any purpose whatever in it, striking as the appearance is.

All these observations on the formation of spores confirm the *general results* which H. von Mohl laid down in his memoir on the development of the spores of *Anthoceros lævis*, Linnæa, 1839, vol. xiii. p. 273—290.

1. *Four spores are always developed in a mother-cell.*

2. *Previously to their development, a granular fluid matter is contained in the mother-cell.* Here it may be added, that this same is formed of the dissolved cytoblasts.

3. *The four spores are formed at the same time, and certainly not,* as Mirbel believed, *by the mechanical division of the cell-mass into four parts by septa, these septa proceeding from the membrane of the mother-cell, but in an independent manner.* To this it may be added, that actual cytoblasts are simultaneously produced in the cell.

The chief conclusion therefore is, *that the process of spore-formation does not differ from the formation of cells through cytoblasts. Psilotum* cannot be too highly recommended for the observation of all these facts, as we here possess extraordinarily large mother-cells which allow all the alterations in their interior to be perceived with the greatest distinctness.

Diversity in the peculiarities of the formation of spores in *Psilotum* from that in *Anthoceros* and other Cryptogamic plants, is of course owing to family and generic differences.

[To be continued.]

XXXI.—*On the Siliceous Bodies of the Chalk and other Formations, in reply to* Mr. J. Toulmin Smith. By J. S. Bowerbank, F.R.S. &c.

In the last January Number of the 'Annals and Magazine of Natural History' there are some observations by Mr. J. Toulmin Smith on the Formation of the Flints of the Upper Chalk, in which the author combats certain conclusions of mine published in the 'Transactions of the Geological Society,' vol. vi. new series, p. 181, relative to the spongeous origin of the flinty bodies of the chalk, greensands, and oolites. Had the differences between the author and myself been merely matters of opinion, I should not have occupied your valuable pages on the present occasion, especially as he has declared* that "it is not his intention to dispute the particular facts stated by myself as applying to the cases

* Page 2.

I have observed;" and granting this, I have really very little more to desire, as the whole of the views exhibited in my paper are attempts to elucidate obscure natural phænomena and not matters of theory; but as in the course of his reasoning upon the evidence which I have produced of the organic origin of the siliceous bodies in dispute, he has referred to natural historical facts in support of his views, and ventured upon assertions based upon these facts which are unfortunately not correct, I should not be doing justice either to the subject or myself if I were not to endeavour to correct these misapprehensions.

The author, after noticing the difference in the views of the formation of chalk flints entertained by Prof. Ehrenberg and myself, proceeds thus*: "It may be allowed to us, in all humility, to call in the aid of other classes of facts to clear up the mystery, and this I now proceed to do. I fully admit that spiculæ are not uncommonly found in some flints, but they are most assuredly not always found; in some flints they are very numerous, while in others from the same spot they are exceedingly rare, and in very many wholly wanting. Now these sponge spiculæ are indestructible. The destruction of the structure of the sponge, which this theory requires as a necessary postulate, would not destroy them. How then is it that they are thus variably present? And it is important to remember that similar spiculæ are found in the chalk itself." In the first place, I deny totally that the destruction of the structure of the sponge is a necessary postulate of what the author designates as my theory. I have never under any circumstances made such an assertion, and if I had, it would have been a most egregious blunder; for the remainder of the passage I may simply say, that the conditions of the structure of the skeleton and the spicula are precisely those which every naturalist acquainted with the Spongiadæ would expect; for although the horny skeletons of the Spongiadæ are very enduring, the gelatinous interstitial substance of the sponge, which in life abounds with spicula, is exceedingly destructible, and is dissolved away from the skeleton almost immediately after the death of the animal; and in many species of *Halichondria* this is so rapidly effected, that a specimen taken fresh from the sea and placed in the hand can scarcely be retained there many minutes without its being flooded with the gelatinous matter shed by the animal, and this equally takes place if the sponge be placed in a small basin of salt water; in a few hours it will have shed the whole of its interstitial gelatinous matter, the dead skeleton only remaining. What is more natural then, than that in the silicified remains of sponges, in which the skeleton has always to a great extent been

* Page 2.

destroyed, the spicula should be but very sparingly found in the fossil, and what more to be expected than that they should be found imbedded in the surrounding chalk?

After some passing observations the author says: "If it is once admitted that flint is ever, or may be even in a single instance, found elsewhere, the theory ceases to be an explanation of the phænomena, and becomes of no value to the philosophical inquirer*." This is really so richly dogmatical that one cannot suppress a smile: does the author seriously think that he can thus fetter by a syllogism those who differ from him in opinion? But even in the face of this denunciation, I will at once admit that flint has been and is continually found elsewhere. It abounds in the mountain limestone formation of England, and I have it through the kindness of Mr. Lyell from the newest freshwater tertiary beds, from Egypt from Prof. Ansted, and out of the late Capt. Clapperton's collection from the neighbourhood of Timbuctoo, and from other parts of the world through various channels; and in all these cases it abounds in animal remains which are under the same conditions as those of the chalk flints.

The author continues, "Now, can it be shown that silex has any peculiar affinity for either the animal substance or the horny skeleton of the sponge? The contrary is known, as matter of fact, to be the case. Facts palæontological as well as recent might be cited in abundance in disproof of this necessary postulate of the sponge theory. I have undoubted sponges in my possession from the chalk, which, instead of being wholly silicified, are in part so, and in part still in the chalk, while the flint is otherwise extended beyond the boundary of the sponge." The author is evidently unacquainted with the second paper which I published in the 'Annals and Magazine of Natural History' in September and October 1842, or he could scarcely have seriously asked the question contained in the first sentence of the last quotation. If he will take the trouble to consult that paper, or to examine a few thinly sliced specimens of moss agates or green jaspers, as they are termed, from India, he will see abundant proofs of the strong predisposition of siliceous matter for the horny skeletons of the Spongiadæ. Every separate fibre which is inclosed forms a distinct nucleus, from which the chalcedonic crystals of the silex spring.

The author states, that the contrary of this predisposition is known to be the fact, but does not adduce a single proof of the correctness of this assertion, although he professes to have an abundance of such; nor does he even attempt to disprove the reasoning which I have advanced in the first paper to prove the ex-

* Page 3.

istence of an elective attraction between the siliceous matter and animal and vegetable remains; nor offer the slightest explanation of the cause of the suspension in all parts alike of the masses of siliceous spicula, the remains of polythalamous shells, small branched corals and numerous other animal bodies; nor account for the continually recurring presence of that tissue, which I have described as, and still believe to be, portions of the skeleton of the sponge to which the great mass of chalk flints owe their origin. If this description of tissue were found only in the flints of the chalk, there might remain room for doubt of its being that which I have asserted it to be; but when we find that the flints of the Portland oolite afford similar remains of a corresponding tissue, but specifically different from that of the chalk flints, and that circumstances of the same description obtain in the flints of the greensand formation and in those of the mountain limestone, such doubts cease to exist, and the fair philosophical inference is, that those tissues are in truth the remains of the spongeous bodies to which these siliceous masses have been indebted for their form.

The author then proceeds to ask*, "Where, in recent sponges, do we find the innumerable quantities of shells and other large objects that we find in the chalk flints?" And after describing some flints with numerous shells attached to them, and specimens of which kind are by no means rare, he proceeds thus†: "I have seen, in Mr. Bowerbank's valuable collection of sponges, a specimen in which one small shell is imbedded: this may have happened in casual instances with small dead shells, but where can it be found, in recent sponges, from the most favourable spots, that they are full, as we find the flints full, of bivalves large, numerous and perfect, and apparently living when enveloped?" In the paragraph immediately preceding the one last quoted, Mr. Smith describes his specimens of flint, not as being full, but merely as having shells attached to the surface of the flint, for he says of the shells in the conclusion to the description of the flints alluded to: "These are lying on the external surface, just sunk, as it were, in the flint, as they would sink in water, but not at all covered." But the author does not give us the slightest explanation of the extraordinary phænomenon he describes of shells partially sunk into all parts of the surface of an irregularly formed nodule of water or fluid silex "of most fantastic form," to quote his own words. It would appear most natural to suppose that the mode of their sinking in water would be at once to the bottom, and not merely to indent the surface and there remain, while, on the contrary, their position is quite natural if the

* Page 4. † Page 5.

body to which they are attached be a sponge. But where, says the author, are such specimens to be found? I answer, in my own collection, and I will show him dozens such if he will favour me with a visit to see them; and I assure him that that which he considers as so very improbable is in truth the natural habit of the Spongiadæ, which attach themselves to both living and dead shells, and in that situation they develope themselves to their full extent, freely rolling about as the tidal or other currents impel them. I have a specimen of Arca with a sponge firmly based upon one valve and loosely embracing the other, and which is many times the bulk of the shell, and the animal still remaining within the shell. Arca, Pecten, Hinnites, Ostrea, and numerous other bivalves, are frequently to be seen thus encumbered with large sponges; and I have also a large keratose sponge from Port Lincoln, Australia, which has more small univalve shells entangled in its meshes than could be counted correctly in a long summer's day; but we need not go to exotic specimens for such proofs, for if the author had only taken the precaution to have consulted Dr. Johnston's excellent 'History of British Sponges,' he would have found it quite unnecessary to have gone further to have satisfied himself of the fallacy of his own imaginations regarding the habits of the Spongiadæ, and I beg to refer him to plates 3, 5, 12, 14 and 15 of that work as pictorial proofs to the contrary of his assertion; and it is well known to every man who has paid the slightest attention to marine natural history, that *Halichondria suberea* described by Dr. Johnston, p. 139. fig. 5 and 6. pl. 12, is rarely met with, excepting partially or wholly enveloping univalve shells, and that these shells are usually inhabited by a Pagurus. I have brought up a dozen or more of such specimens at each haul of the dredge in Weymouth Bay and in the neighbourhood of Tenby, and I have many such in my possession at the present moment. It is as much the habit of the animal to be parasitic upon shells, as it is for *Dromia lator* and other species of the genus, during its life, to carry a living ambush of sponge upon its back, to secure which in its proper situation nature has stinted the growth of the two hinder pairs of legs, and directed them over the back of the animal to hook into and hold firmly the mass of sponge under which it lives and moves.

There is also another crab, which I believe belongs to the genus *Pericera*, which is in the constant habit of cherishing the growth of long fistulose sponges on the front spines of its shell, and these sponges often attain three or four times the length of the crab. I have in my possession at the present moment five specimens of the latter and ten of the former, bearing each his sponge; and in one case the mass of sponge is as big as my two fists placed together, and in several of the smaller ones the sponge is so big

in proportion to the crab as entirely to conceal it when viewed from above. There is no special preference on the part of the crabs for any particular genus or species of sponge, but these differ in almost every instance in my possession, and in one case a single crab of the latter genus has three species fixed upon its shell. The author continues: "It is assumed by this theory that the sponges grew over the shells and other organic objects which lay on the surface of the mud. But the observed facts are wholly at variance with this assumption." I have before my eyes at the moment of writing this, a sponge of the genus *Halichondria* from Van Diemen's Land of an oval form, seven inches and a half long by five and a half wide, and not more than two inches thick, which once grew spreading on the bottom of the sea, and in the under surface of which sponge there are more single valves and fragments of bivalves and univalves than I can attempt to count with success; and my friend Mr. Frederic Catherwood, whose beautiful work on the Extinct Cities of Central America has made him so favourably known to the public, informed me that during a coasting voyage in a canoe, of about 100 miles, along the shore of South America, one of his chief amusements was to lie with his head over the bows of the canoe and feast his eyes with the splendid and variegated carpet of sponges of all descriptions of form and colour, which almost covered the bottom of the shallow sea over which he was voyaging. But here again we need not transport ourselves to South America to illustrate this fact—the cave under St. Margaret's Island at Tenby will suffice for our purpose. In this place I have found seven or eight species of British sponges spreading over the surface, and rendering the rocks beautiful with their tints of green, orange, yellow, red, &c. The author then proceeds: "The Echinites alone, extensively examined, afford conclusive evidence against the sponge theory. These are very frequently indeed found in the very centre of flints. They are sometimes found with spines affixed, and therefore alive or with undecomposed soft parts when entombed. The masses of flint to which they are affixed are very frequently not attached to either of the large orifices of the shell, but to some part of the sides, while the shell is entirely filled with flint and both orifices closed. Mr. Bowerbank states that, when the shell is not entirely filled with flint, in 'the space thus unoccupied by the flint was always included one or both of the large orifices of the shell.' I do not find this fact in *any* degree borne out by my own observations." With regard to the last sentence, I can only say, the author must have been very unfortunate in his observations not to have found my assertion "in any degree" borne out; that in the cases where the shell was only partially filled with flint, one or both of the large orifices

of the shell were always included in the empty space. I can only say that I shall have much pleasure in showing him, at any time, nine such specimens in one drawer of my collection.

With regard to the fact that the shell of an Echinite should be partially or wholly filled with silex, and then attached by some part of its surface unconnected with the great orifices to a mass of flint, it is in no respect unnatural among recent sponges. Two separate individuals are often based upon the same stone or shell, and if they grow sufficiently large to touch each other, they unite organically and form one sponge; but if they be not of the same species, they will grow over or envelope each other, but never unite organically. I have several such specimens from Algoa Bay and from Wollongong near Sydney, and of the latter description I have one specimen which is composed of three species. Sometimes an individual of a different species will be developed upon the very summit of another sponge, and both live and thrive under these circumstances; such a specimen I have from Wollongong. I have also from the West Indies a Verongia seven or eight inches long so completely enveloped by a large fistulose spongia that not more than about one inch of its length is exposed, and yet both species were alive when taken from the sea. Is it unnatural then, that among the Wiltshire flints we should find one, two or three species of sponge included within another parasitical and casing sponge, and that the included ones should not be united to the enveloping one? On the contrary, it is what we see is the habit of the Spongiadæ of the present day, and therefore exactly what we should expect to have been the case with the fossil species. And again, with regard to the filling of the dead shells of Echinites and other hollow bodies with sponge. It is true I cannot show the author an Echinus shell filled with sponge, but thanks to my friend Mr. Pickering, who presented me with the specimens, I can show him nine cases of the interiors of bivalves of various genera, which have been, some wholly, while others are only partially filled by the common sponge of commerce; and what could scarcely have been expected, there is not one of the casts in which the shell has been gaping, but eight of them have had both valves closely shut, and in the ninth one very nearly so, and in this the sponge extends by means of a thin plate beyond the boundaries of the front of the valves of the shell. In these cases, which afford beautiful casts of the interior of the shell, and exhibit on their surfaces the impression of the muscular attachments and striæ of the valves, each cast has its characteristic enveloping membrane, and as the sponge has needed no support, it has not attached itself to any portion of the interior surface of the shell. The author thinks it highly improbable that teeth, wood and other extraneous bodies should be enveloped

in sponge. He can have seen but very few species of the recent Spongiadæ to be thus surprised; they abound in such extraneous matters, and moreover are the natural habitation of many species of *Balanus* and other genera of shells, just as we find among the Corallidæ certain genera and species of shells which are familiar to every conchologist as occurring in such situations and in none other. Is it then a wonder that living things should be enveloped in sponges, either ancient or modern, seeing that in many cases it is their natural and inevitable situation?

The author then alludes to the fact of the pulp-cavities of the teeth in the fragment of a jaw of Mososaurus in the possession of Mr. Charlesworth being filled with silex, and quotes this as inimical to my views of the origin of flint; and in this opinion some time since I know my friend Mr. Charlesworth shared; but after having at the British Association expressed his views regarding this interesting specimen, he with his usual liberality gave me permission to take a thin longitudinal slice from the centre of one of these flint casts of the pulp-cavity, and upon examining this through the microscope in the usual manner it was found to exhibit all the characteristic appearances of flint nodules. Two specimens of *Xanthidium* and numerous polythalamous shells were imbedded in the midst of it, and a considerable quantity of the remains of sponge tissue is apparent round the edges of the slice. Now it must be borne in mind that the fossil was but the fragment of a jaw when imbedded in the chalk, and I believe, from my recollection of the specimen, that at the time of its imbedment it had lost the lower edge or keel of the bone: is it therefore to surprise us, that such bodies as sponge gemmules, often much less than one hundredth of an inch in diameter, having ciliary locomotive power, should insinuate themselves into the pulp-cavities, either through the nerve or blood channels, or by means of the space between the tooth and its socket after the animal matter lining the latter has been removed by maceration, and there develope themselves and fill up the space of the cavity? Neither is it unnatural, that such minute living bodies as microscopic foraminifera and *Xanthidia* should be found in such a situation, as sponges are continually inhaling currents of water through one set of canals and ejecting it as continually through others, and this with no small degree of power.

When I was at Tenby some years since, I placed some specimens of *Halichondria panicea*, Johnston, in a shallow dish of sea-water, and in one of them in which the orifice of the excurrent canal was more than half an inch below the surface of the water, the outpouring current was so strong, that when the reflection of one of the bars of the window was brought over the orifice of the sponge, the reflected line was curved to a very consi-

derable degree, so as to render it evident that the surface of the water was elevated by its power the tenth or the eighth of an inch, and some light dust shaken over the spot was dispersed in a circle with great rapidity. I have seen the same phænomenon in vivid action with *Grantia botryoides* in a closed cell filled with sea-water beneath the microscope, when at Weymouth in the year 1845. Need we wonder then, with such powers inherent in the Spongiadæ, that minute animal or vegetable organisms should be found in such positions as those alluded to by Mr. Smith? But there is yet another way in which the filling of the pulp-cavity and the space intervening between the tooth and its socket may be accounted for in the small jaw figured by the author, and it is simply this: that as the whole of the fragment of the jaw has been built over by the sponge originating the flint, it is quite natural that it should have insinuated its fibres into those spaces in thin plates, and such thin plates of single layers of reticulated fibre, not exceeding the five-hundredth of an inch in diameter, may be frequently seen by the aid of a lens in the sponges of commerce, especially at the termination of the excurrent canals of the West Indian species. But in reality Mr. Smith's specimen needs none of these conditions to account for the presence of the silex in any one part of it more than in another, as the whole substance of the jaw is more or less silicified, which fact was not observed by the author at the time of the publication of his paper. There is nothing more surprising in this replacement of carbonate or phosphate of lime in bone by silex, than there is in like replacements in the shells of the greensand formation and of the London clay, *Voluta luctator* and other shells. The same phænomenon takes place in the corals of the mountain limestone of Derbyshire, Ireland and elsewhere; and this I believe to take place without the presence of any degree of heat above the ordinary mean temperature of the earth, and for this reason; that in almost every flint that I have examined, I have found evidence of chalcedonic crystallization wherever there has been a small space originally not occupied by spongeous substance. And in almost every moss agate it may be seen that the fibres are the prevailing nuclei of crystallization; from these they constantly radiate until the various crops of crystals meet at their apices and form ultimately the solid mass of the agate. In fact, the process of siliceous deposit in these organized fossils appears to be precisely the same in principle as in the deposit of siliceous matter in hollow spaces in rocks of igneous origin, only that in the first case the place of crystallization is determined by the presence of the organic fibre of the sponge, and in the latter case simply by the sides of the cavities in the rock. We find also in chalk flints, that where there has happened to be a large central cavity, the sides are often coated

with half an inch in thickness or more of pure chalcedony, and then succeeds a crop of regular crystals of quartz. The like is familiar to every mineralogist in agates from rocks of volcanic origin, in the cavities of which, the water, perhaps containing but a very few per cent. of silex, may by gradual and continuous filtration have deposited the silex long after the rocks had ceased to possess a greater degree of heat than the ordinary temperature of the earth.

If, on the contrary, we imagine a high degree of thermal heat necessary for the conveyance and deposit of the silex, how is it that the water at this high temperature spares the carbonate of lime in the beautiful and delicate shells which are often attached to the surface of the chalk flints, and the numerous remains of cartilaginous and other fishes, crustacea, and other delicate animal remains which abound in a most perfect condition amidst the very flints that are supposed to require so great a degree of thermal heat for their formation? And if the deposit of the silex be determined by any great degree of thermal heat, it may naturally be supposed that it would be deposited somewhat in the form of that precipitated from the waters of the Great Geyser and other such springs; but this is not the case. In the flints and agates the normal form of the deposit is the compressed acicular crystallization of chalcedony; while in the latter it is purely amorphous, the highest power of the microscope affording not the slightest indications of crystallization: in fact, it is the well-known mineral, siliceous sinter. I have examined specimens of this mineral bearing the impressions of leaves recently brought from the Great Geyser by Mr. C. C. Babington, and with a power of 500 linear it presents a purely resinous or glassy structure; not the slightest trace of radiating crystallization even from the parts which bear the impress of the leaves.

The author then treats of the fossilization of Choanites and Ventriculites, and describes them as imbedded in flint, and possessing "a light floating elegance of form as if still enjoying life in their native liquid element; and which facts assure us that they were thus suddenly and instantaneously fixed in a moment of the highest vitality." I really cannot understand how the author arrives at this conclusion, that because they retain their form they were necessarily imbedded alive. We are all familiar with the very long time that a piece of common sponge will do duty in a water-filter, for months or even years, without the destruction of its texture; and the recent genera to which the fossil sponges termed Ventriculites and Choanites belong, are of a much stronger and more horny structure. The recent type of the former I have received from my friend Capt. Ince, R.N., who procured it at Torres Straits, and another species from the Phi-

lippine Islands by Mr. Cuming; and I have the fac-simile of *Choanites Kœnigii* both single and double, and of about the same size as the fossil species from Wollongong near Sydney, Australia.

The author, dismissing the evidence to be derived from the internal conditions of flints, then proceeds to consider their external forms, and says: "And we shall find, on taking a careful review of some facts of the external forms and modes in which the flints are found, that the sponge theory is not only wholly unsatisfactory, but absolutely impossible." I reply to this simply by asking the author why such an origin for the chalk flints should be impossible, seeing that the author does not deny the existence of other sponges of undoubted character in a silicified state; and but a few paragraphs previous to the one quoted, he describes the investment of Ventriculites by silex as if it were quite a natural event. Now if one sponge may be thus invested and imbedded by silex, why not another? To me, the whole difference appears to be, that the one was more prone to decomposition after death than the other, and therefore that we find its skeleton in a worse state of preservation than in fossilized Ventriculites and Choanites.

The author having obliged me with an inspection of the specimens he has figured, I may briefly say, that the supposed revolving particles in flint represented by the woodcut, page 11, and for the peculiar motion of which amidst the imaginary fluid flint, the author offers no principle, are in my idea merely the remains of one of the large internal canals of the sponge, the natural arrangement of the particles of which, as a matter of course, presents the appearance described by the author.

There appears to me nothing in either of the originals of figures 2 and 3, Plate I., that is in any degree anomalous. In No. 2 a portion of the stem (*c*) has broken away from the base of the Ventriculite after it had become silicified, an accident very likely to happen during the subsequent elevation of the chalk, and which process was probably going on during the period of its deposit. No. 3 presents the imbedment of fragments, some of which appear to have been shells, on the under surface of the flint, the carbonate of lime having been replaced by silex; others are simply fragments of older flints. Figure 1 represents a mass of flint which exhibits an appearance of having been deposited in concentric layers which are exposed by what seems to have been an irregular decomposition of its surface. I have often met with this anomalous structure, containing the same organic remains as those in the common chalk flints, but I have not yet obtained a clue to the origin of its peculiar form: nor do I think Mr. Smith's hypothesis of two currents in contrary directions, and one whirlpool in about six superficial inches, at all likely to afford that clue, as unluckily there are another set of contrary currents

in opposition to the figured side also to be explained, and moreover the author does not give us any principle upon which these minute currents can be accounted for.

In treating of the probable origin of these figured specimens the author says *: "The movement which caused this fracture and impelled the pieces on to the yet fluid mass was probably the same which caused the whole surface on which the fractured pieces alighted to slip forwards, and which surface and the mass beneath it, probably by the very agitation thus caused, instantly solidified, leaving the ridge *a b*, and fixing the fractured pieces firm.

"This case illustrates and demonstrates all the conditions already noticed; extreme liquidity and rapid solidification of the flint, together with the soft state of the surrounding chalk."

Here the author distinctly recognises the theory of the gelatinous condition of flint, although he appears in the commencement of the paper to have repudiated it, and in the following page he says †: "Where organic remains of any considerable size, or grouped in particular masses, happened to be abundant and lie near one another, they acted as separate centres, while the solution was attracted to them in a mass." I must confess that this mode of accounting for the fantastically-formed nodules of flint is perfectly incomprehensible to me. I cannot by any stretch of the imagination conceive a mass of saturated solution of "extreme liquidity" preserving its integrity for a moment at the bottom of the ocean, and especially amidst so many minute currents as the author supposes to exist. But let us see what foundation we have for the supposed "masses" of solution of silex.

Throughout the whole of the report of Dr. Turner's lecture, there is nothing touching the existence in nature of a gelatinous condition of silex beyond the supposition of Brongniart that such might be the case, and which is expressed thus ‡: "In the formation of chalcedony and flint, it was most likely, as Brongniart supposed, that the silica, as in operations in the laboratory, was deposited in a gelatinous form, hardening gradually by evaporation and the cohesive attraction of its particles." By the use of the word *evaporation* it is evident that the passage is not applicable to the conditions of silex in solution in the depths of the ocean. The author then proceeds thus: "The regularly disposed lines which were so beautifully displayed in some varieties of chalcedony, seemed owing to successive deposition—one layer succeeding another, each assuming the form and irregularities of the preceding,

* Page 15. † Page 16.
‡ London and Edinb. Phil. Mag. vol. iii. p. 27.

and differing in tint according to the absence or presence of small varying quantities of foreign matter, such as iron or manganese."

It is evident from this passage that Dr. Turner had chalcedony more especially in his mind when he penned this passage, and that in reality he believed flints to have originated from organized bodies by slow infiltration, for the last passage quoted is immediately succeeded by the following one: "In the case of flint it was necessary," he said, "to account for that remarkable tendency which silica possessed to occupy the place of organic matter, as exemplified by the specimens of flint, silicified wood, and coral on the lecture-table. This phænomenon the lecturer thought might be explained on the principles which had been developed that evening. Siliceous solutions infiltrating through organic masses in progress of decay, might readily be decomposed by the affinity of gases or other compounds generated during slow putrefaction, either for the silica itself or for its solvent. In either case a deposit of silex would result." From this passage it would appear that, although he quotes the supposition of Brongniart, he was for his own part of opinion that the slow infiltration and deposit through the agency of the decomposition of organic bodies had been the means of the formation of flint.

Let us now inquire what foundation there is for the supposition that flints are formed from detached masses of gelatinous solution of silex. Have such solutions ever been found in nature? Is there a single writer on chemistry or mineralogy who describes such a condition of silex as natural? Mackenzie in his account of Iceland speaks of the vast deposits of silex in the form of siliceous sinter, and of its encrusting the living stems of grasses, but says not a word of its ever occurring in the gelatinous form under any circumstances; and Mr. C. C. Babington, who has recently returned from a visit to the Geysers, confirms this account, and also has told me that in no case did he see anything in the form of a soft or gelatinous deposit of silex in the neighbourhood of the springs, although he saw the Great Geyser more than once in full action. Certainly if there be any place in the world where we should expect to find this gelatinous form of silex deposited in a natural condition, it is there, where the waters are so high in temperature and so abundantly charged with the earth in solution, and yet nothing approaching to it has ever been observed by the most enlightened and observant visitors of the spot. From our own knowledge of nature, therefore, we may reasonably arrive at the conclusion that such a natural condition of silex as the gelatinous one is no more to be expected than that we should find pure potassium or sodium occurring in the bowels of the earth, or any other such substance which is the

result of chemical science only, and not the natural condition of the bodies in question. We can only therefore regard the idea of Brongniart as a pure hypothesis, which is very much easier to invent than it is to carefully work out the truth by laborious investigation.

And again, let me ask, what is the necessity for resorting to far-fetched hypotheses to account for the presence of the silex, when we have such frequent and obvious evidences of its great prevalence in solution in water under almost every description of circumstances? We have but to examine wheaten straw to be assured of its having been imbibed by the plant from the water of the soil during its growth and secreted as one of its component elements in great abundance; and every little boggy hole that is filled with water, every pond, ditch, lake, river or sea, swarms with Desmidiæ and infusorial animalcules alike secreting silex as their outward covering and protection, evincing in all these situations the abundance of the earth in question in solution; and geology is proving to us daily that such also has been the case from time immemorial. No vast pressure, no high temperature is in reality required to sustain silex in solution, and this is readily to be proved by reference to springs in our own country, as at Bath, where the hot-bath spring yields 128 gallons of water per minute, or 184,320 gallons per day; and as each pint of the water, according to the analysis of Mr. R. Phillips, contains one-fifth of a grain of silex, there is consequently $35\frac{1}{2}$ pounds of solid silex poured forth in solution in every day's discharge, or 12,857 lbs. per annum, and the water has a temperature of only 117° Fahr. The Great Geyser in Iceland jets forth a column 200 feet high and 10 feet in diameter at a boiling temperature, and contains, it is said, 31·38 grains of silex per gallon. If these two comparatively insignificant sources produce thus much of silex, ought we to be at all either surprised or astonished at the universal presence of this earth in solution?

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

December 8, 1846.—George Gulliver, Esq., F.R.S., in the Chair.

A paper was read containing descriptions of 38 new species of Land-shells, in the collection of Hugh Cuming, Esq., by Dr. L. Pfeiffer:—

1. Parmacella Cumingi, Pfr. *Parm. testâ depresso-semiovatâ, tenuissimâ, striatâ, lineis spiralibus subtiliter decussatâ, diaphanâ,*

pallidè virenti-corneâ vel (in adultis) succineâ; spirâ vix prominulâ, subpapillatâ; anfractibus 2; columellâ arcuatâ, acutâ.

Long. 6, lat. 6, alt. $2\frac{3}{4}$ mill.

From the island of Juan Fernandez (H. Cuming).

2. SUCCINEA PALLIDA, Pfr. *Succ. testâ ovato-conicâ, solidiusculâ, longitudinaliter ruguloso-striatâ, diaphanâ, pallidè stramineâ; spirâ acutâ; anfractibus 4 convexis; columellâ leviter arcuatâ, filari, supra basin aperturæ ovalis subtruncatâ; peristomate margine subincrassato.*

Long. 13, lat. 7, alt. $6\frac{1}{2}$ mill.; apert. $8\frac{1}{2}$ mill. longa.

From Tahiti (H. Cuming).

3. SUCCINEA SEMIGLOBOSA, Pfr. *Succ. testâ ovato-semiglobosâ, tenui, lævigatâ, nitidissimâ, lutescenti-corneâ; spirâ vix prominulâ, obtusâ; anfractibus 2, ultimo ventroso; columellâ strictiusculâ, obliquè recedente; aperturâ rotundato-ovali.*

Long. 8, lat. $6\frac{1}{2}$, alt. 4 mill.; apert. $7\frac{1}{2}$ mill. longa.

From the island of Massafuera, Chile (H. Cuming).

4. SUCCINEA TAHITENSIS, Pfr. *Succ. testâ ovatâ, striatulâ, tenui, vix nitidâ, pellucidâ, pallidè succineâ; spirâ brevi, obtusiusculâ; anfractibus $2\frac{1}{2}$ convexis, ultimo ovato; columellâ leviter arcuatâ, medio obsoletè (interdum distinctè) angulatâ; aperturâ regulariter ovali; peristomate expansiusculo.*

Long. 12, lat. 7, alt. $4\frac{1}{2}$ mill; apert. $8\frac{2}{3}$ mill. longa.

From Tahiti (H. Cuming).

5. HELIX LINDONI, Pfr. *Hel. testâ imperforatâ, semiglobosâ, tenui, irregulariter striatulâ, supernè opacâ, albidâ, punctis castaneis conspersâ et lineâ nigricanti-castaneâ ad suturam ornatâ; anfractibus $4\frac{1}{2}$ convexiusculis, ultimo basi planulato, pellucido, corneovirente, anticè breviter deflexo; columellâ intrante, declivi, subarcuatâ, dilatatâ, introrsum acutâ; aperturâ lunato-ellipticâ; peristomate simplice, recto.*

Diam. 16, alt. $9\frac{1}{2}$ mill.

From the island of Cuba (Lindon).

6. HELIX PEMPHIGODES, Pfr. *Hel. testâ imperforatâ, subglobosâ, tenui, membranaceâ, obliquè plicatulâ, diaphanâ, lutescenti-corneâ; spirâ brevi, papillatâ; anfractibus 4 vix convexis, ultimo permagno, carinato, juxta suturam inflato, basi convexo, anticè vix descendente; columellâ simplice, acutâ, subverticali; aperturâ amplâ, ferè circulari; peristomate simplice, acuto, marginibus conniventibus.*

Diam. 18, alt. 12 mill.

From the island of Cuba (Lindon).

7. HELIX GRADATA, Pfr. *Hel. testâ imperforatâ, globoso-turbinatâ, striatulâ, tenui, hyalinâ; spirâ turbinatâ, ad apicem acutâ; anfractibus 6 convexiusculis, gradatis, ultimo medio acutè carinato, basi convexo, sub lente minutissimè concentricè striato; aperturâ subtetragono-lunari; peristomate simplice, acuto, margine columellari verticaliter descendente.*

Diam. 5, alt. 5 mill.
From the island of Leyte (H. Cuming).
Nearly allied to *H. tongana*, Quoy.

8. Helix Barclayana, Pfr. *Hel. testâ umbilicatâ, depresso-turbinatâ, confertim obliquè costatâ, albâ, epidermide fusco-olivaceâ indutâ; spirâ conoideâ, apice obtuso; suturâ profundâ; anfractibus* $5\frac{1}{2}$ *convexis, ultimo medio carinato (interdum obsoletè bicarinato), basi convexiusculo; umbilico mediocri, ferè cylindrico; aperturâ subverticali, quadrangulari; peristomate simplice, acuto, margine columellari verticaliter descendente, cum basali angulum formante.*

Diam. 18, alt. 12 mill.
From the island of France (Sir D. Barclay).

9. Helix arcuata, Pfr. *Hel. testâ umbilicatâ, orbiculato-convexâ, tenui, pellucidâ, pallidè corneâ, confertim et regulariter arcuato-plicatâ; spirâ latè conoideâ, apice obtusiusculo; anfractibus 6 vix convexiusculis, carinâ acutâ, serratâ marginatis, ultimo circa umbilicum magnum, ferè cylindricum subcompresso; aperturâ angulato-lunari, latâ; peristomate simplice, acuto, margine columellari brevi, verticali.*

Diam. $5\frac{1}{2}$, alt. $2\frac{3}{4}$ mill.
From the province of Cagayan, island of Luzon (H. Cuming).

10. Helix Mighelsiana, Pfr. *Hel. testâ umbilicatâ, globosâ, solidâ, validè et confertim plicatâ, spiraliter obsoletè striatâ, rufâ vel lutescenti-fuscâ; spirâ conoideo-semiglobosâ; anfractibus 5 convexiusculis, ultimo ventroso, anticè vix descendente, circa umbilicum angustum compresso; aperturâ subverticali, rotundato-lunari; peristomate recto, intus albo-labiato, margine columellari dilatato-patente.*

Diam. 19, alt. 15 mill.
From Surigao, island of Mindanao (H. Cuming).

11. Helix Rissoana, Pfr. *Hel. testâ perforatâ, globosâ, tenui, striatâ, diaphanâ, vix nitidâ, rufâ; spirâ conoideâ, obtusiusculâ; anfractibus 6 convexiusculis, ultimo subangulato, medio pallidè cingulato, anticè breviter descendente, basi ventroso; aperturâ magnâ, semicirculari; peristomate intus rubello-labiato, breviter expanso, margine columellari in laminam brevem, perforationem semioccultantem reflexo.*

Diam. 18, alt. 13 mill.
From Greece (Lieut. Spratt, R.N.).

12. Helix dictyodes, Pfr. *Hel. testâ angustè umbilicatâ, depressâ, sublenticulari, obliquè plicato-striatâ, tenuiusculâ, diaphanâ, pallidè corneâ, fusco subtiliter reticulatâ et maculis castaneis juxta suturam et carinam ornatâ; spirâ latè conoideâ; anfractibus 7 vix convexiusculis, ultimo acutè carinato; aperturâ subverticali, depressâ, lunari, intus margaritaceâ; peristomate simplice, margine columellari breviter dilatato-patente, basali sinuoso, reflexiusculo.*

Diam. 27, alt. 12 mill.
From New Guinea (Ince).

13. HELIX LIGNARIA, Pfr. *Hel. testâ imperforatâ, subgloboso-depressâ, solidâ, lævigatâ, castaneâ, fasciis variis epidermidis hydrophanæ, fusco-cinereæ obductâ; spirâ vix elevatâ, obtusâ; anfractibus 4½ vix convexiusculis, celeriter accrescentibus, ultimo ad peripheriam subangulato; columellâ strictiusculâ, perobliquâ, latâ, planatâ, fuscâ; aperturâ rotundato-lunari, intus albidâ; peristomate subincrassato, brevissimè reflexo, fusco-marginato.*
Diam. 45, alt. 27 mill.
From Surigao, island of Mindanao (H. Cuming).

14. HELIX CRASSILABRIS, Pfr. *Hel. testâ imperforatâ, depressâ, crassâ, ponderosâ, irregulariter striatâ et undique granulatâ, albidâ, lineis spiralibus, undulatis, fuscis, fasciâque unicâ ad peripheriam ornatâ; spirâ vix elevatâ, distinctè granulatâ, apice nudo, albo; anfractibus 4½ planiusculis, sensim accrescentibus, ultimo minutissimè granulato, medio subcarinato, anticè vix descendente; aperturâ obliquâ, semiellipticâ, intus albâ; peristomate undique incrassato-reflexo, margine dextro subsinuoso, columellari intus obsoletè plicato.*
Diam. 42, alt. 22 mill.
From the island of Cuba (Lindon).

15. HELIX SPENGLERIANA, Pfr. *Hel. testâ imperforatâ, depressâ, solidâ, striatâ, nitidâ, pallidè castaneâ; spirâ parum elevatâ, obtusâ; anfractibus 5½, supremis planis, minutissimè granulatis, 2 ultimis convexis, ultimo medio obtusè carinato, basi convexiusculo; aperturâ perobliquâ, lunari, intus fusculâ; peristomate latè expanso, breviter reflexo, marginibus callo nitido junctis, basali sinuoso, reflexo, subappresso, columellari perdilatato, adnato, umbilicum prorsus tegente.*
Diam. 49, alt. 26 mill.
From the island of Jamaica (Gosse).

16. HELIX CODONODES, Pfr. *Hel. testâ umbilicatâ, globoso-conoideâ, solidâ, obliquè striatulâ, lineis spiralibus confertis subtilissimè sculptâ, nitidâ, albâ, castaneo-bifasciatâ; spirâ campanulatâ, apice obtusiusculo; anfractibus 5½ vix convexis, ultimo anticè deflexo, basi juxta aperturam gibboso-subconstricto; aperturâ obliquâ, ferè circulari; peristomate incrassato, reflexo, marginibus approximatis, callo nitido junctis, columellari dilatato, patente, sinuoso.*
Diam. 20, alt. 17 mill.
From the Philippine Islands (H. Cuming).
The described specimen shows a tooth-like protuberance on the inner side of the columella, which seems not to belong to the essential characters of this species.

17. BULIMUS CASTUS, Pfr. *Bul. testâ subperforatâ, ovato-conicâ, tenuiusculâ, minutim et obsoletè decussatulâ, hyalino-albidâ, basi et prope aperturam erubescens; spirâ conicâ, acutiusculâ; anfrac-*

tibus 5½ convexiusculis, ultimo spiram paulò superante; columellâ strictiusculâ, filiformi; aperturâ oblongâ; peristomate simplice, roseo, marginibus subparallelis, callo tenui junctis, dextro breviter expanso, columellari brevissimè reflexo, perforationem ferè claudente.

Long. 19, diam. 9 mill.

From Central America? (Lattre).

18. Bulimus erubescens, Pfr. *Bul. testâ subperforatâ, oblongo-turritâ, læviusculâ, lineis spiralibus sub lente insculptâ, carneo-luteâ, apice rubicundâ; spirâ turritâ, apice acuto; anfractibus 6 planiusculis, ultimo spirâ paulò breviore; columellâ supernè subtortâ, basi paulò recedente; aperturâ oblongâ, intus nitide albâ; peristomate simplice, margine dextro expansiusculo, columellari fornicatim breviter reflexo, subappresso.*

Long. 24, diam. 10 mill.

Locality unknown.

19. Bulimus rimatus, Pfr. *Bul. testâ profundè rimatâ, oblongo-turritâ, tenuiusculâ, subarcuatim striatulâ, pallidè corneâ; spirâ turritâ, obtusiusculâ; anfractibus 7 ferè planis, ultimo ⅜ longitudinis æquante, basi rotundato; columellâ intus uniplicatâ; aperturâ oblongo-ovali; peristomate simplice, marginibus approximatis, callo junctis, dextro vix expanso, columellari dilatato, patente.*

Long. 33, diam. 11 mill.

Locality unknown.

20. Bulimus Studeri, Pfr. *Bul. testâ perforatâ, oblongo-conicâ, tenuiusculâ, striatulâ, lineis spiralibus confertis sub lente decussatâ, nitidâ, albâ, cingulis angustis, roseis 3–4 ornatâ; spirâ conicâ, acutâ; anfractibus 6 vix convexiusculis, ultimo $\frac{4}{9}$ longitudinis subæquante; columellâ arcuatâ; aperturâ ovali-ellipticâ, intus concolore; peristomate simplice, marginibus subconniventibus, dextro breviter expanso, columellari fornicatim reflexo, roseo.*

Long. 25, diam. 10 mill.

From Central America? (H. Cuming).

21. Bulimus Moricandi, Pfr. *Bul. testâ perforatâ, ovato-conicâ, tenui, lineis spiralibus subconfertis insculptâ, subdiaphanâ, citrinâ; spirâ conicâ, acutiusculâ; suturâ pallidè submarginatâ; anfractibus 6 vix convexis, ultimo spiram æquante; columellâ strictâ; aperturâ suboblongâ, truncato-ovali, intus concolore; peristomate simplice, breviter expanso, margine columellari supernè breviter patenti-reflexo.*

Long. 24, diam. 12 mill.

From Mount Coban, Central America (Lattre).

22. Bulimus Ehrenbergi, Pfr. *Bul. testâ profundè rimatâ, oblongâ, solidâ, obliquè striatulâ, albidâ; spirâ oblongâ, apice attenuato, obtusiusculo; anfractibus 7½ vix convexiusculis, ultimo ⅖ longitudinis paulò superante; aperturâ angulato-ovali; peristomate incrassato, breviter reflexo, marginibus callo crasso, prope inser-*

tionem labri tuberculifero junctis, columellari dilatato, crasso, patente.

Long. 24, diam. 10 mill.

From Cerigotto, Greece (Lieut. Spratt, R.N.).

23. Bulimus Rossmassleri, Pfr. *Bul. testâ profundè rimatâ, oblongâ, solidulâ, confertim rugoso-plicatâ, supernè fusco-corneâ, basi sordidè albidâ; spirâ oblongo-conicâ, apice obtuso; anfractibus 8 vix convexiusculis, ultimo basi rotundato, $\frac{1}{3}$ longitudinis æquante; columellâ brevi, strictiusculâ; aperturâ truncato-ovali, intus albâ; peristomate albo-labiato, breviter expanso, marginibus callo tenui, juxta insertionem labri dentifero junctis, columellari dilatato, patente.*

Long. 19, diam. 7 mill.

Locality unknown.

24. Bulimus Draparnaudi, Pfr. *Bul. testâ subobtectè perforatâ, oblongo-subfusiformi, striatulâ, opacâ, nitidâ, albâ, cærulescenti-nebulosâ, strigis nigro-castaneis et brunneis, interdum maculosè interruptis, ornatâ; spirâ turrito-conicâ, ad apicem acutâ; anfractibus 7 convexiusculis, ultimo $\frac{3}{8}$ longitudinis subæquante; columellâ rectâ; aperturâ oblongâ; peristomate simplice, acuto, margine columellari dilatato, membranaceo, angulatim reflexo, appresso.*

Long. 28, diam. 11 mill.

β. *Minor, interstitiis strigarum castaneo-litturatis.*

From Chilon, Bolivia (Bridges).

25. Bulimus Ziegleri, Pfr. *Bul. testâ subperforatâ, ovato-conicâ, tenui, confertim striatulâ, lineis spiralibus sub lente obsoletè decussatâ, albidâ; spirâ conicâ, acutiusculâ; anfractibus 6 vix convexiusculis, ultimo medio subangulato, spirâ paulò breviore; columellâ paulò recedente; aperturâ ovali; peristomate simplice, margine columellari breviter reflexo, subappresso.*

Long. 21, diam. 10 mill.

β. *T. pellucidâ, lutescente, fasciis castaneis, supremis maculosè interruptis, cinctâ.*

Locality unknown.

26. Bulimus Sayi, Pfr. *Bul. testâ subperforatâ, ovato-oblongâ, solidiusculâ, confertim rugoso-plicatâ, nitidâ, albâ, strigis pellucidis, fuscis ornatâ; spirâ conicâ, obtusiusculâ; anfractibus 6 vix convexis, ultimo spiram subæquante, basi attenuato, circa perforationem obsoletam fusco-areolato; columellâ leviter arcuatâ; aperturâ elliptico-oblongâ, intus fusco-carneâ; peristomate simplice, margine columellari breviter reflexo, subappresso.*

Long. 20, diam. 9 mill.

Locality unknown.

27. Bulimus coniformis, Pfr. *Bul. testâ subperforatâ, ovato-conicâ, tenui, irregulariter striatâ, fuscescenti-albidâ, strigis obliquis, fuscis signatâ; spirâ conicâ, acutiusculâ; anfractibus 5 planiusculis, ultimo spiram paulò superante, medio angulato, basi subcompresso; columellâ leviter arcuatâ; aperturâ ovali, utrinque*

angustatâ; peristomate simplice, recto, margine columellari supernè dilatato, breviter reflexo.
Long. 12, diam. $6\frac{1}{2}$ mill.
From Merida, Andes of Bolivia (T. Bridges).

28. Bulimus Sowerbyi, Pfr. *Bul. testâ perforatâ, ovato-conicâ, tenui, sublævigatâ, albidâ, strigis obliquis, castaneis, maculas albas pyramidales et rhomboidales formantibus ornatâ; spirâ conicâ, acutâ; anfractibus $6\frac{1}{2}$ vix convexiusculis, ultimo spiram æquante, medio pallide, juxta basin attenuatam castaneo-unifasciato; columellâ paulò recedente; aperturâ oblongo-ovali; peristomate simplice, recto, margine columellari angulatim latè reflexo, plano.*
Long. 22, diam. 10 mill.
From the Columbian Andes (Lindon).

29. Bulimus porphyrius, Pfr. *Bul. testâ perforatâ, oblongo-attenuatâ, solidiusculâ, confertim et ruditer corrugatâ, castaneâ, strigis albis irregulariter marmoratâ; spirâ conicâ, ad apicem obtusâ; suturâ submarginatâ, irregulariter crenatâ; anfractibus 7 planiusculis, summis subtiliter granulatis, ultimo spirâ paulò breviore; columellâ subrectâ; aperturâ angustâ, oblongâ; peristomate simplice, acuto, margine columellari dilatato, reflexo, carneo-livido, perforationem ferè occultante.*
Long. 51, diam. 20 mill.
From Bolivia (T. Bridges).

30. Bulimus Voithianus, Pfr. *Bul. testâ perforatâ, subfusiformi-oblongâ, solidulâ, rugis longitudinalibus et lineis concentricis impressis ruditer granulatâ, sordidè albâ; spirâ conicâ, ad apicem acutiusculâ; anfractibus 6–7 vix convexiusculis, ultimo spirâ paulò breviore; columellâ subverticali, nigro-castaneâ; aperturâ angustâ, oblongâ, intus castaneâ; peristomate simplice, recto, marginibus callo fusco junctis, columellari dilatato, fornicatim reflexo, perforationem profundam non tegente.*
Long. 19, diam. $7\frac{1}{2}$ mill.
From Chile (T. Bridges).

31. Bulimus castrensis, Pfr. *Bul. testâ angustè umbilicatâ, oblongo-conicâ, lævissimè striatulâ, opacâ, albidâ, strigis spadiceis denticulatis et maculis albis pyramidalibus ornatâ; spirâ conicâ, acutiusculâ; anfractibus 7 vix convexiusculis, ultimo ventrosiore, infra medium lineis nonnullis spadiceis cincto, $\frac{2}{5}$ longitudinis subæquante; columellâ strictiusculâ; aperturâ oblongâ; peristomate simplice, recto, margine dextro supernè arcuato, columellari dilatato, patente.*
Long. 19, diam. 9 mill.
Locality unknown.

32. Bulimus andicola, Pfr. *Bul. testâ perforatâ, turrito-conicâ, solidâ, lineis concentricis, confertis sub lente sculptâ, opacâ, nitidâ, albâ, strigis fuscis, linearibus irregulariter ornatâ; spirâ elongatâ, acutiusculâ; anfractibus 7 convexiusculis, ultimo $\frac{3}{7}$ longitudinis subæquante, basi rotundato; columellâ deorsum aliquantulum rece-*

dente; aperturâ ovali-oblongâ; peristomate simplice, acuto, margine columellari supernè fornicatim reflexo, perforationem angustam formante.

Long. 24, diam. 11 mill.

From the Columbian Andes (Lindon).

33. Pupa elegantula, Pfr. *Pup. testâ breviter rimatâ, subcylindraceâ, apice obtuso, lævigato, nitido, hyalino; anfractibus 7 planiusculis, ultimo præcedente paulò angustiore, extus medio sulcato, intus lamellis 2 validis, suturæ parallelis, plicâque profundâ columellæ parallelâ munito; aperturâ subsemicirculari, lamellâ parietis aperturalis intrante juxta insertionem labri coarctatâ; peristomate expansiusculo, margine dextro flexuoso, medio subincrassato.*

Long. $6\frac{2}{3}$, diam. 3 mill.

Locality unknown.

34. Achatina Lamarckiana, Pfr. *Ach. testâ ovato-conicâ, solidâ, ponderosâ, ruditer plicatâ, in fundo albido strigis fulminatis nigricantibus et castaneis, maculisque rufis variegatâ; spirâ conicâ, pallidâ, apice obtusiusculo; anfractibus 8 convexiusculis, supremis lineis spiralibus obsoletè decussatis, ultimo ventroso, spiram superante; columellâ arcuatâ, purpureo-callosâ, supra basin aperturæ obliquè et leviter truncatâ; aperturâ ovali, intus margaritaceâ, cærulescente, saturatius marmoratâ; peristomate fusco-limbato, marginibus callo purpureo junctis.*

Long. 103, diam. 52 mill.

From the interior of the island of Madagascar.

35. Achatina Rangiana, Pfr. *Ach. testâ elongatâ, turritâ, solidâ, ponderosâ, lævissimè arcuatim substriatâ, lineis spiralibus distantibus notatâ, stramineâ, apice albo, obtusiusculo; suturâ lævissimâ; anfractibus 11 planulatis, ultimo $\frac{1}{4}$ longitudinis paulò superante, basi rotundato; columellâ rectâ, callosâ, ad basin aperturæ breviter et obliquè truncatâ; aperturâ subsemiovali, intus margaritaceâ; peristomate simplice, acuto.*

Long. 39, diam. 11 mill.

From Mexico (Lindon).

36. Achatina bulimoides, Pfr. *Ach. testâ ovato-conicâ, tenui, striatâ, epidermide corneo-luteâ, pellucidâ indutâ; spirâ conicâ, acutâ; anfractibus $5\frac{1}{2}$ vix convexis, ultimo ventrosiore, spiram æquante; columellâ supernè tortâ, filari, supra basin aperturæ obsoletissimè truncatâ, callo tenui ventrem anfractûs penultimi vestiente munitâ; aperturâ latè semiovali; peristomate simplice, tenui.*

Long. 11, diam. 6 mill.

From the island of Juan Fernandez (H. Cuming).

37. Achatina (Glandina) Lindoni, Pfr. *Ach. testâ oblongâ, utrinque attenuatâ, solidulâ, lævigatâ, nitidâ, pallidè fulvâ, lineis incrementi arcuatis, vix prominentibus, saturatioribus notatâ; spirâ conicâ, acutiusculâ; suturâ submarginatâ; anfractibus 8 planiusculis, 2 ultimis obliquè descendentibus, ultimo spiram*

æquante, supra columellam intus gibboso; columellâ brevi, ad basin aperturæ obliquè truncatâ; aperturâ angustissimâ, basi subcanaliculatâ; peristomate simplice, marginibus callo junctis, dextro antrorsum arcuato-dilatato.

Long. 21, diam. 6 mill.

From the island of Cuba (Lindon).

38. Cylindrella Sowerbyana, Pfr. *Cyl. testâ truncatâ, cylindraceo-subulatâ, solidiusculâ, obliquè subarcuatim costulato-striatâ, opacâ, cinnamomeo et albo radiatâ; anfractibus* (*spec. trunc.*) 16 *angustis, convexiusculis, ultimo basi subcarinato* (*carinâ parum prominente, ferè rectangulâ*), *anticè vix protracto, subtilius striato; aperturâ subcirculari; peristomate undique libero, tenui, breviter expanso, margine supero sursum dilatato.*

Long. 35, diam. 8 mill.

From the island of Cuba (Lindon).

December 22.—R. C. Griffith, Esq., in the Chair.

The following descriptions of new species of *Chama*, by Lovell Reeve, were communicated by Hugh Cuming, Esq.

Chama fimbriata. *Cham. testâ suborbiculari, valvis ambabus concentricè fimbriato-lamellatis, valvarum marginibus minutè crenulatis; lutescente-albâ.*

Hab. Point Cunningham, North Australia; Dring.

A very distinct species, though its characters are set forth in few words; the lamellæ are not isolated as in most of the genus, but arranged in concentric continuous wavy frills.

Chama panamensis. *Cham. testâ ovatâ, circiter trigonâ, lateraliter affixâ, valvâ superiore posticè lævi, tenuissimè appresso-laminatâ, anticè rugosâ, rudè fimbriatâ, inferiore lævi, per basim lamellatâ, valvarum marginibus lævibus; albidâ, ferrugineo-fusco hic illic tinctâ.*

Hab. Panama (attached to stones); Cuming.

The upper valve of this shell is distinguished in a peculiar manner by its twofold style of sculpture.

Chama prætexta. *Cham. testâ ovatâ, valvis ambabus concentricè pulcherrimè fimbriatis, fimbriis tenuibus subpellucidis, grandibus, plus minusve erectis, valvarum marginibus lævibus; pallidè croceâ, fimbriis supra rufescentibus.*

Hab. —— ?

This truly delicate and beautiful shell was received by Mr. Cuming from a continental naturalist of some celebrity as the *C. croceata* of Lamarck, but it does not answer to the description. There are several Lamarckian species of this genus, and even the Linnæan *C. gryphoides*, which it is quite impossible to identify with the least degree of certainty.

Chama exigua. *Cham. testâ parvâ, tenui, subpellucidâ, circiter trigonâ, lateraliter affixâ, valvâ superiore minutissimè appresso-*

laminatâ et radiatim striatâ, subasperâ, inferiore divaricatim excavato-punctatâ, per basim lamellatâ; albâ.

Hab. Singapore (dredged from sandy mud at the depth of seven fathoms attached to fragments of shells); Cuming.

A little transparent white shell, of which Mr. Cuming collected several specimens; the lower valve is distinguished by a peculiarity of punctured sculpture somewhat analogous to that of the *C. arcinella*; there is no trace of it, however, in the upper valve, as in that species.

Chama fragum. *Cham. testâ suborbiculari, valvâ superiore concentricè tenuissimè fimbriato-laminatâ, laminis marginem versus subtubulosis, inferiore rudè tubuloso-squamatâ, valvarum marginibus minutè crenulatis; albâ, rufo-punctatâ, intus albidâ.*

Hab. Island of Mindoro, Philippines (attached to coral); Cuming.

The sculpture of this species somewhat approaches that of the *C. spinosa*; it is of a more minute and delicate character and easily distinguished on comparison.

Chama variegata. *Cham. testâ oblongo-ovatâ, circiter trigonâ, valvâ superiore lamellatâ, præcipuè in seriebus duabus posticis, lamellis latiusculis appressis, interstitiis obliquè rugoso-liratis, squamis perpaucis brevibus remotis, valvarum marginibus lævibus; corallo-rubrâ, liris lamellis squamisque albis, intus albidâ, rufo-fusco tinctâ.*

Hab. Honduras; Dyson.

The colouring of this shell has a very pretty effect, the oblique ridges and other external sculpture being white upon a coral or orange-red ground.

Chama cistula. *Cham. testâ orbiculari, posticè profundè sinuatâ, valvis ambabus peculiariter rudè lamellatâ et squamatâ, squamis ad margines subproductis, appressis, valvarum marginibus lævibus; albidâ, roseo-fuscescente variâ, intus albâ.*

Hab. Honduras; Dyson.

The upper valve of this shell is rather more convex than usual; the sculpture peculiarly rudely developed.

Chama tumulosa. *Cham. testâ orbiculari, posticè subprofundè sinuatâ, valvis ambabus valdè convexis, rudè tumulosis et imbricatis, interstitiis posticè obliquè liratis, liris minutissimè squamatis, valvarum marginibus lævibus; aurantio rufoque variâ, liris posticis albis, intus albâ.*

Hab. Honduras (attached to coral); Dyson.

A striking species, though of rude growth; it is doubly sinuated on the posterior side, having round orange protuberances along the summit, whilst the channeled interstices have a striped appearance, from their being crossed by white ridges on a blood-red ground.

Chama lingua-felis. *Cham. testâ orbiculari, supra depressiusculâ, valvis ambabus præcipuè inferiore minutè retusè squamatis, superiore pulcherrimè fimbriato-laminatâ, laminis appressis, posticè concavo-planatâ, ad angulos elongato-lamellatis, valvarum marginibus lævibus; niveâ, rosaceo hic illic tinctâ.*

Hab. Island of Guimaras, Philippines (attached to stones); Cuming.

An extremely delicate and characteristic species, in which the upper valve is very finely laminated, whilst the ground sculpture of both that and the lower valves is of a curious roughened character, somewhat similar to the *Tellinæ scobinata* and *lingua-felis*.

CHAMA PELLIS-PHOCÆ. *Cham. testâ suborbiculari, valvâ superiore undique minutissimè squamatâ, squamis umbonem versus brevissimè retusis, marginem versus longioribus subspiniferis, inferiore rudè lamellatâ, valvarum marginibus lævibus; albâ, squamis marginem versus rufo-fuscis, umbone roseo.*

Hab. Island of Ticao, Philippines (attached to stones); Cuming.

The pink stain upon the umbone is probably a character which may help to distinguish this species.

CHAMA APPRESSA. *Cham. testâ orbiculari, valvis ambabus concentricè laminatis, laminis tenuibus plano-appressis, inferiore posticè liris perpaucis minutis obliquè exsculptâ, valvarum marginibus lævibus; albâ, roseo-fuscescente sparsim tinctâ.*

Hab. Honduras; Dyson.

Distinguished by its concentric flatly appressed laminæ.

CHAMA RUPPELLII. *Cham. testâ suborbiculari, valvâ inferiori valdè productâ, crassiusculâ, lævigatâ, plus minusve erosâ; albidâ, valvarum marginibus internis vividè rufo-purpureis.*

Hab. Red Sea.

Approximating closely to the *C. iostoma*, but from so remote a locality that I venture to distinguish it as a new species.

CHAMA BRASSICA. *Cham. testâ suborbiculari-ovatâ, circiter trigonâ, valvis ambabus rugosis, profusè squamatis, squamis valvæ superioris subfoliaceis, inferioris brevibus, erectis; albidâ, squamis roseis.*

Hab. Island of Cabul, Philippines (under stones at low water); Cuming.

An interesting species, curiously scaled, and of peculiarly circuitous growth.

CHAMA CARDITÆFORMIS. *Cham. testâ transversim oblongâ, valvis ambabus radiatim minutissimè squamæ liratis, squamis appressis, posticis majoribus, valvarum marginibus crenulatis; albâ, lirarum interstitiis posticè coccineo-rufis.*

Hab. —— ?

Easily distinguished by its peculiar oblong growth, which apparently is not accidental.

CHAMA VENOSA. *Cham. testâ circiter trigonâ, lateraliter affixâ, valvis ambabus lævibus, radiatim subobsoletè tricostatâ, costis asperè nodulosis; albâ, lineis purpureo-roseis obliquis undique venosâ, intus albâ.*

Hab. —— ? (Attached to shells.)

The blood-red lines with which the entire surface of this shell is

painted are not less characteristic than the three faint sharply-noduled ribs.

Chama Janus. *Cham. testâ circiter trigonâ, valvâ inferiore et dimidio postici superioris lævibus vel obliquè obtusè liratis, squamarum brevium seriebus duabus radiantibus, valvâ superiore undique irregulariter appresso-squamatâ, valvarum marginibus lævibus; purpureo-rufâ, liris obliquis squamisque albis.*

Hab. Gallapagos Islands (attached to the large *Aviculæ*); Cuming.

The general aspect of this shell is not much unlike that of *C. venosa*, but the difference may be easily detected on examination; instead of being veined with fine lines of colour upon a white ground, the oblique ridges are raised upon a red ground; besides this, the upper valve is characterized by a double style of both colour and sculpture, the anterior half being of a dull brick-red colour and appressly scaled, whilst the posterior half is similar to the under valve. Mr. Broderip has figured this shell as the young *C. imbricata*, but it is far removed from that species.

Chama rubea. *Cham. testâ ovatâ, circiter trigonâ, valvis ambabus rudè flexuosis et appresso-laminatis, squamis perpaucis, valvarum marginibus subtilissimè crenulatis, purpureo-rubrâ, squamis albidis, intus albâ, margine purpureâ.*

Hab. Cagayan, island of Mindanao, Philippines (attached to stones); Cuming.

The under valve of the specimen here represented is more squamate, and the scales are more erect than the upper.

Chama Jukesii. *Cham. testâ ovatâ, valvis ambabus profusè et confertissimè brevispinosis, spinis valvæ inferioris subsquamatis; intus extusque niveâ, umbonibus apice pallidè purpureis.*

Hab. Cape Upstart, North Australia (on the coral reefs at low water); Jukes.

I dedicate this shell with a great deal of pleasure to Mr. Jukes, the zealous naturalist of H.M.S. The Fly, to whom this monograph is indebted through Mr. Cuming for several interesting species.

Chama sarda. *Cham. testâ suborbiculari, valvis ambabus peculiariter exiliter obliquè striatis, squamis brevibus asperis remotis; intus extusque vividè corallo-rubrâ.*

Hab. Honduras (attached to coral); Dyson.

Rich in colour and very characteristic in sculpture, being crossed in an oblique direction throughout with faint striæ, and roughened here and there with short scales, like the asperities of a coarse file.

The following paper, by Dr. J. H. Jonas, containing descriptions of two new Shells, was also communicated by Hugh Cuming, Esq.

Pyrula idoleum, Jonas. *Pyr. testâ oblongo-fusiformi, biconicâ, umbilicatâ, testaceo-albâ, transversim regulariter liratâ, sulcis interjectis angustis, liris sub lente squamosis; anfractibus sex per longitudinem leviter plicatis, medio acutè angulatis; angulo costâ undulatâ munito; costâ squamis imbricatis oculo nudo vix conspicuis distinctâ; caudâ spirâ breviore, recurvâ et squamis armatâ;*

apertura pyriformi, intus striata, columella lævi, nitidiuscula, cylindracea, canali recurvo, aperto.

Long. $17\frac{1}{2}$, lat. $9\frac{3}{4}$ lin.

Patria?

(Exstat in museo Gruner.)

The form of this shell differs so much from all those known to me, that I find it impossible to compare it with any of them; its only resemblance is to a product of art—to the roof of a Chinese pagoda, and for this similarity's sake I have named it *Pyrula idoleum*. Starting from the supposition that in former times men took the productions of nature which surrounded them as models for their works of art, the peculiar form of this shell has suggested to me the conjecture that it originates from China; in all probability we shall yet obtain from this country many strange forms, as for example the *Pyrula Maweæ*, which is brought from the Chinese Sea.

Anomia naviformis, Jonas. *An. testa transversim elongata, angusta, tenui, pellucida, marginibus dorsali et ventrali parallelis, rectis, lateralibus brevibus, rotundatis; valva majore ænea, valde concava, minore alba, fragilissima, concaviuscula; foramine ovato, integro.*

Long. 16, lat. 4 lin.

Patriam ignoro.

This Anomia may perhaps be an aberrant form of the *A. ænigmatica*, with which it has great resemblance in the texture of the shell, position of the umbones and form of the foramen; but I do not dare to assert this, and therefore I describe it as a peculiar species till intermediate species are found, forming the links of a chain, of which the above two are the terminating ones.

Mr. Tomes exhibited to the Meeting a specimen of the Bimaculated Duck, *Anas glocitans*, which he had obtained in Leadenhall-market; the specimen is a female, and agrees in size and plumage with that in the Society's collection.

ROYAL INSTITUTION.

March 5, 1847.—"On the Successive Phases of Geological Science." By Prof. Ansted.

The lecturer stated that he proposed to give something of a psychological view of geological history,—tracing the successive ideas that seem to have prevailed and to have chiefly contributed towards the advancement of the science,—and pointing out how far these ideas involved truth, and how far errors of exaggeration, although they were useful as suggesting new views and observations. After passing rapidly under review the philosophy of the ancients and the cosmogony of the middle ages—which latter he described as without the true aspect of philosophic investigation—the lecturer referred to the discoveries of Werner as being the first which distinctly created geological science. He stated that these discoveries induced three important assumptions:—first, that the whole crust of the earth had

been deposited mechanically from water; secondly, that the newer deposits were generally horizontal; and, thirdly, that there was an invariable order of superposition of similar mineral types. The idea thus involved was that of "the universality of formations," and a perception of order in the arrangement of the materials of which the earth's crust is made up; and the idea was described as useful and suggestive, although the conclusions were in many important respects unsound. While Werner was thus laying the foundation of geology by observations and speculations on mineral structure, William Smith, the father of English geology, had obtained an insight into an important fact concerning the distribution of fossil bodies; and at the same time Dr. Hutton, in his 'Theory of the Earth,' had recognised a succession of worlds and a history of the nature of the succession by the agency of causes not different from those still in action. The idea involved in the discoveries of Smith was, that "fossils are characteristic of formations;" while Hutton first appreciated the importance of existing causes. The next step in geological discovery was described as the result of Cuvier's investigations in palæontology, and the establishment of the law of the adaptation of structure to habit in all animals. This law however is combined with another, also of great importance—that there is in all nature a permanence of typical peculiarities. Modified and brought to bear on fossils in this way, the "law of universal adaptation" was described as the suggestive idea in this step of geological progress; while the law afterwards made out concerning the *representation* of species in time as well as space was mentioned as affording important accessory aid in applying palæontology to the determination of geological problems. After referring to the subject of geological classification, and describing it as the result of the working out of these various laws, the lecturer briefly stated the actual results of observation in descriptive geology, and the nature of the most remarkable speculations in physical geology; but the latter were rather indicated in allusions to the desiderata in that department than dwelt upon or described directly. Among these desiderata he particularly referred to the condition of knowledge with regard to metamorphic rocks, and their relations with rocks of distinctly igneous origin on the one hand, and the fossiliferous stratified rocks on the other. He stated that much yet remains to be done in connecting the present with the immediately antecedent condition; but expressed grounds for belief that investigations actually in progress may lead to some satisfactory and fixed conclusions. The making comparative observations on a large scale was mentioned as an important means of advancing geological science: and in conclusion, Prof. Ansted spoke of the necessity of distinguishing in all cases the true objects of geology, and stated his firm conviction that geology would soon occupy a very important place as an inductive science, leading to great practical results.

March 12.—"On the Causes and Amount of Geological Denudations." By Mr. A. C. Ramsay.

Mr. Ramsay commenced by defining the term "geological denu-

dation," in its strictest sense, to be the removal of portions of the earth's surface by water, so as to expose to view the rocks previously concealed beneath that surface. He briefly adverted to the various effects produced by running water; but enlarged principally on the action of the sea—that being the principal agent employed in the destruction and reproduction of strata mechanically deposited in water. To show the bearings of this, he explained the action of the sea on certain coasts; showing the manner in which the breakers act on coasts composed of rocks of unequal hardness, and on others which, from the peculiar position of portions of their component strata, are more or less easily wasted by the waves. The manner in which a country is affected by these operations, according as it may be rising above or sinking beneath the waters, was expounded, and the processes by which the débris thus won from the land is spread abroad in the surrounding seas; showing that periods of slow depression are most favourable for the accumulation of great thicknesses of strata and the preservation of organic remains—the reverse being the case during periods of elevation. Mr. Ramsay applied these principles to explain the geological history of South Wales and the neighbouring counties, showing the amount of denudation that the rocks beneath the new red sandstone had suffered at various periods. This was illustrated by certain of the sections of the Geological Survey of Great Britain, drawn on a true vertical and horizontal scale of six inches to a mile. In these, the older disturbed rocks beneath the new red sandstone (viz. coal-measures, carboniferous limestone, old red sandstone and Silurian formations) were shown to have been all bent and contorted together. He explained the principles by which the curvatures of disturbed strata beneath the surface are deduced; and on these principles he had restored the curves that the same strata (once having, in these districts, been continuous) would follow if now joined above the existing surface of the land. This gave an approximation to the quantity of matter removed by denudation from above that surface—amounting over great part of the country *to ten or twelve thousand vertical feet of solid rock*; part of which, on the outskirts of Wales and in Somersetshire, was removed during the new red sandstone and liassic periods; and the greater part—viz. the interior of Wales—since the deposition of the London clay;—the seas of the oolite and cretaceous periods never having penetrated into the interior of Wales. It was during tertiary times that the removal of this great mass by sea denudation was effected; this denudation giving to the country its present contour of hill and valley.—*Athenæum.*

BOTANICAL SOCIETY OF EDINBURGH.

Feb. 11, 1847.—Dr. Greville, President, in the Chair.

The following communications were read:—

1. A letter from Capt. Portlock, giving a short account of his horticultural proceedings at Corfu, and suggesting the *Convolvulus Batatas*, or sweet potato, as a substitute for the potato; the plant has

been introduced into Corfu, and apparently with success. Capt. Portlock describes it as an excellent vegetable, being dry, and between the potato and parsnep in taste.

2. "On the Defoliation of Trees," by the Rev. Dr. Fleming. After referring to the extremely defective nomenclature connected with the "defoliation of trees" employed in the writings of Lindley, Gray, and others, the author called the attention of the Society to a classification of the phænomena which he had published in the 'Edinburgh Journal of Science' (Brewster) in Jan. 1826, and where leaves are arranged in reference to their duration into three groups—*Folium deciduum, Folium annuum, Folium perenne.* In the first class the leaves cease to exercise their functions when the buds have been perfected, and fall off in succession before winter; or, when the plant is trained as a hedge, they frequently remain until the evolution of the buds in the following spring. In the second class the leaves outlive the winter, and do not die or fall off until a number of new leaves have been evolved for the support of the plant in spring or summer. Such are the bay, laurel, holly and ivy, which are never without living leaves, while in the first class such leaves are periodically wanting. In the third class the leaves continue to exercise their functions for several years, as in the Firs, an arrangement in part connected with the ripening of the seeds. He then proceeded to expose the erroneous views of those who maintain that it is only the buds of a tree which are alive, and that its *timber* is dead, and destined to serve merely as a *soil* for the buds on their evolution in spring. He restricted his proofs to the leaves and branches connected with them which live throughout a succession of seasons—to the mode in which buds can be *forced*—and to the individual differences preserved, in the case of fruit-trees, between the stock and graft during the whole period of their connection.

3. "On *Carex saxatilis* (L.) and *Carex Grahami* (Boott)," by Dr. Balfour, who endeavoured to show that intermediate forms exist which seem to connect the two species. He exhibited specimens picked on Ben na Cruichben, near Killin, in 1844, which showed characters partly of the one species and partly of the other; all gradations are found from the true form of *C. saxatilis* with its rounded or ovate, dark, erect spikes, ovate, beaked, emarginate perigynia slightly longer than the scale, to *C. Grahami* with its oblong-ovate, somewhat nutant spikes, and bifurcate perigynia twice as long as the scales.

Dr. Balfour exhibited a series of American Ferns from Dr. Gavin Watson of Philadelphia, among which the following were the most interesting species and varieties:—*Cistopteris tenuis* of Schott, a variety of *C. fragilis,* and various intermediate forms; *Polystichum acrostichoides*, some specimens with rounded pinnæ, and others with the pinnæ much divided and deeply serrated—among the latter were several with the fructification extending to the lowest pinnæ; *Diplazium thelypteroides* of Presl, several with segments of the pinnæ very acute; *Lastræa spinulosa,* various forms, including *L. intermedia* of American botanists; *Lastræa lancastriensis,* a form approaching *L. cristata,* but apparently distinct: in some specimens the frond w...

alternately pinnate, with the pinnæ approximated, cleft, or slightly pinnatifid, the segments rounded or slightly toothed; in others the pinnæ were deeply pinnatifid and much toothed, more or less acute; while in a third set the frond was bipinnate. Numerous intermediate forms were exhibited, showing the transition from the one to the other. *Athyrium Filix-fœmina* of Roth; of this fern a complete series was shown, connecting the typical form of the species with the various forms to which the names of *irriguum, angustatum* and *asplenoides* have been given by some botanists who regard them as distinct species.

Dr. Greville, who had carefully examined the specimens of the two last-mentioned ferns, was of opinion that *Lastræa lancastriensis* is a good species, and that all the forms of *Athyrium Filix-fœmina* exhibited were referable to one species.

Dr. Balfour also showed specimens of *Hieracium rigidum*, var. *angustifolium*, from near Inversnaid, Loch Lomond; *H. prenanthoides*, Habbie's Howe, Pentland Hills; and *Mimulus luteus*, near an old reservoir, Pentlands. The last-named plant has now been found in several spots near Edinburgh; also on the banks of the Clyde near Glasgow; near Largs; in Perthshire, Stirlingshire and Aberdeenshire; near Morpeth and in South Wales. He also mentioned the discovery of *Achillæa tanacetifolia* in England.

March 11.—Professor Balfour in the Chair.

The following communications were read:—

1. "List of plants collected in the neighbourhood of Auchincairn, Kirkcudbrightshire, in July and August 1846," by W. Wells, Esq., communicated by Sir Wm. Jardine, Bart. The author enumerated the plants which he had noticed in the district named, among which were many rare and some interesting alpine species.

2. "Description of a new species of *Dawsonia*," by Dr. Greville. This splendid moss, of which a specimen and drawing were exhibited, has been named *D. superba* by Dr. Greville. It was received from Australia; the specimen exhibited was 14 inches high, with leaves fully an inch in length. [See p. 226 of the present Number.]

3. "Notice of Palms at present in flower in the Royal Botanic Garden," by Dr. Balfour. 1. *Livistona chinensis*, Mart. The plant in the garden is about thirty-six years old, 25 feet high, and the stem at the base has a diameter of 22 inches. The leaves are upwards of 13 feet long, and the blade of the leaf 7 feet across; the spadices 4 to $4\frac{1}{2}$ feet long. It is believed that this is the first time the palm has flowered in Britain.—2. *Euterpe montana*, Graham, or Mountain Cabbage-Palm. The plant in the garden used to fruit regularly, but of late years no fruit has been produced, although it continues to flower abundantly. It is now 30 feet in height.—3. *Chamærops humilis*, or European Fan-Palm. It has for many years produced staminiferous flowers only, but this season produced staminiferous and pistilliferous flowers, and the fruit was apparently perfect.

4. Dr. Balfour stated that he had obtained information that the *Luzula nivea*, discovered last year in a wood near Broomhall by Dr. Dewar, had been planted there by the former gardener, so that it can have no claim to rank as a British plant.

MISCELLANEOUS.

REPRODUCTION OF LOST PARTS IN ARTICULATA.

To the Editors of the Annals of Natural History.

Hammersmith, 5th March 1847.

GENTLEMEN,—Will you kindly allow me to mention, for the information of some of your readers who may have been led (from Mr. Newport's observations in the March Number of the 'Annals') to suppose that I had quietly taken up a theory of his and passed it off as my own, that my remarks (to which he alludes) were made at a meeting of the Entomological Society when he himself was in the Chair, and that instead of applying to the spines and spurs of the tibiæ of the reproduced legs of an insect (such spines and spurs being articulated appendages of the limb), my observations referred to the membranous lobes of the femur, tibiæ and tarsus of the leg of a species of *Phasmidæ* in my own collection, such lobes being integral, and not articulated, portions of the joints? It was from this circumstance, in conjunction with Mr. Fortnum's observations, that I was led to believe that the limb of my specimen had been reproduced.

I shall not further notice Mr. Newport's observations than to state that the abnormally small size of a leg must necessarily be the result of retarded development in those species which have apodal larvæ, as must also the diminished size of the wing in any species. Illustrations of many such abnormities will in due time be given to the public.

I am, Gentlemen, your obedient servant,

J. O. WESTWOOD.

NOTE ON A BRITISH SPECIMEN OF OCULINA PROLIFERA.

For a considerable time that beautiful coral, *Oculina prolifera*, has been known, though not generally, to be a native of the Norwegian seas; but it is entirely to the Rev. Dr. Fleming that naturalists are indebted for the fact, that it is also a member of the British fauna: the fact however has never yet been so satisfactorily proved as to command an unqualified conviction. About twelve years ago a fine mass of this coral, measuring eleven inches in diameter, was presented to the Newcastle Museum by Mr. G. C. Atkinson, one of the Honorary Curators, who received it from a friend, with the statement that it had been brought up by the fishing-lines from deep water on the coast of Shetland; but so doubtful were the then officers of the Institution as to so tropical a form being a native of Britain (especially when there was a probability of its having been lost overboard from some foreign vessel, supposing that it had actually been fished up from where it was stated, and such like instances do occasionally occur; for example, a large specimen of *Gorgonia flabellum*, now in the museum, was brought up by the lines of the Cullercoats fishermen last year), that it was thought best not to

mark any locality on it. A few months ago Mr. Atkinson called my attention to the circumstances connected with this specimen ; and on examining it, I very soon became convinced, that it was truly a native inhabitant, and that it had in reality lived on the coast of Shetland, inasmuch as there were positive evidences that it had grown on the upper valve of a *Crania anomala, or the celliferous surface* of a *Retepora Beaniana* (which proved that the latter had not grown on it), and on pebbles identical with some in the museum that had been procured by Dr. Charlton in Shetland, and to which the same species of *Crania* and the same species of *Retepora* are attached.

Dr. Johnston has noticed the specimen in the 2nd edition of his 'British Zoophytes;' but as nothing is mentioned proving its locality, I have deemed it necessary to state these particulars.

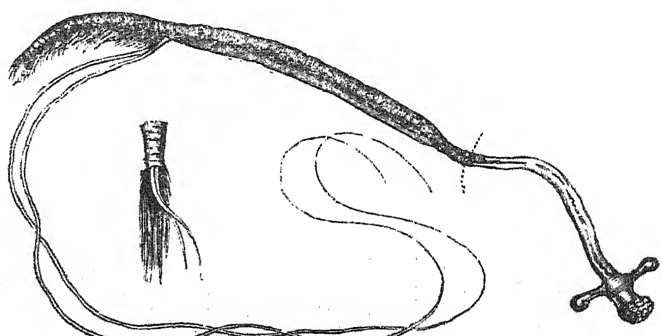
William King.

Newcastle-on-Tyne Museum, March 17, 1847.

ON A NEW SPECIES OF PENELLA.

"In lat. 11° 54′ S., long. 27° W., I found a new and remarkable parasite belonging to the genus *Penella*, subsisting on the body of a dolphin (*Coryphæna*) ; it was buried in the fish near the gills as far as the junction of the neck with the abdomen.

"I am favoured with the following description of it by my friend Dr. Baird of the British Museum :—Class Crustacea, Division Entomostraca, Legion Siphonostoma, Order Lernida, Family Lerneocerida, Genus Penella, Species *P. pustulosa*, Baird. Head rounded and furnished with small fleshy projections of a light red colour. Two fleshy prolongations at its base, short and obtuse, terminating



at the tip in a small red knob. Neck long and slender, and as well as the head transparent, showing the intestine and red blood. Abdomen of a very dark purple colour, and studded all over with small whitish pustules. Plumose appendages simple. Ovigerous tubes very long and slender. Length four inches."—*Angas' Savage Life and Scenes in Australia, &c.*, vol. i. p. 31.

Report on behalf of the Section of Zoology by the Secretary, Prince Bonaparte, read in the concluding General Meeting of the Eighth Italian Scientific Congress, Sept. 29, 1846.

The Report is introduced by a notice of the eminent naturalists of various countries who formed the Members and officers of the Section, among whom occur the names of Filippi, Bassi, Panizza, Spinola, Rüppell, Schmid, Durazzo, Verany, Kœlliker, Lurati of Lugano, Giordani, and Gioberti of Turin. The distinguished Secretary then proceeds:—

Although I shall give but a rapid sketch of the subjects treated of, their number and importance will not appear the less. The memoir of Panizza on the movement of the water surrounding the branchiæ of the *Proteus anguinus*, and of the larvæ of the Salamanders and Tritons, would alone suffice to confer honour upon a Section. Nor of less importance to science were the memoirs of De Filippi on the development of the *Clupeæ*, on the embryogeny of the Gudgeon, in which he perfected his theory of the liver; not to mention another excellent one on the ova of the Valvatæ. Kœlliker discoursed to us on the structure and development of the lymphatics and capillaries in the larvæ of the Frogs, and the anatomy of *Tristoma papillosum*; and followed out the unfolding of the nervous fibres from their origin to their termination. Oronzio Costa of Naples wrote to us upon the *Tristoma coccineum*, also on the form and structure of the heart and the bulb of the branchial artery of fish. From his son, our able coadjutor, there was sent to us the pterygo-tympanic apparatus of various families of fish; from Restani a phrenological communication; from Dubini the anatomy of *Anchilostoma duodenale*; from Bourcier the organ of silk in silk-worms, upon a monstrosity in which Bassi made some observations. Dorotea sent us his researches upon the contents of the small ovarian vesicles in cows; De Martino on the beating of the heart, on the spontaneous contraction of the muscular fibres, and his reports on the relation of the corpus luteum with the folliculus of Graaf; Rusconi on the passage of injections in the lymphatics through the veins by endosmosis. And the President exhibited delicate preparations of the tracheæ of insects, which prove, from their being coloured by alimentary substances, that the fluid circulates within them.

Anatomy was prolific, and we found Zoology not less so. As regards the Mammiferæ, Genè made a communication on the golden-coloured teeth of the goats of the isle of Tavolara; d'Hombre Firmas on the dog in the grotto of Pozzuoli; and Patellani spoke upon the zoological characters of domestic animals. On Birds, Riboli treated phrenologically of the Gallinaceæ; Durazzo on various doubtful species of Passeraceæ; De Selys Longchamps sent a memoir on *Passer pusillus*, with other ornithological notices; and from Blyth at Calcutta came a paper on the Columbidæ; whilst Lanfossi gave a description and plate of *Euspiza dolychonia*. Verany figured other *Emberizæ*, with *Emb. Selysii*, a new species; Astengo detailed the habits of the *Emberiza rustica*. As for Reptiles, Gangadi sent some species from Corfu, one of which, new as to that island, was *Able-*

pharus Kitaibeli. The Secretary presented a monography, upon which he had been engaged, of the order Testudineæ, besides a systematic enumeration of the Reptiles and Amphibia of Europe. Genè gave an interesting description of the amours of the Snakes which greatly entertained the Assembly, dispelling entirely the horror and needless dread of these crawling animals.

As to Fishes, the Secretary explained the characters of the chief divisions; and the Assistant-Secretary read a notice on the *Petromyzon marinus*, and discoursed convincingly on the puncture of the *Trachini.* Important observations on European Fish were made by Rüppell, and numerous additions to the list of Ligurian Fish by Verany, among which is the new species *Cybium Bonapartii,* an engraving of which he distributed. Amati gave an account of an African fish inhabiting thermal waters, which drew from Prof. Orioli some remarks evincing his science and erudition. D'Hombres Firmas exhibited the fossil teeth of the *Sphærodus Gigas,* and Nardo contributed his ichthyological lucubrations. The Marquis Mazzarosa of Lucca gave us in the department of Insects an important communication on the *Tryps* which injures the olives. Achilles Costa described some species of Neapolitan Coleoptera; G. Bertoloni four new species from the coast of Mozambique; the Swede Loewenhjelm the *Phryganea phalænoides,* never found since the days of Linnæus. In Mollusks, Verany described and figured new and rare Cephalopodi, and Kœlliker related curious facts respecting the males of these animals. Calcara gave a catalogue of the Mollusca of Sicily, with a description of new species.

As to Radiata, Michelin described a remarkable new species of Echinoderm; and the very eloquent Professor Meneghini, the pride of Italian Algology, very fully illustrated the anatomical plates of Ranieri, hitherto removed from the light of science.

Beyond the sphere of its own department, the Section of Zoology extended its attention to subjects in connexion with commissions serviceable to humanity, to pasturage, and to agriculture, resolving queries proposed by other Sections, teaching the hygiene of cattle through the instrumentality of Fossati, and overthrowing ridiculous prejudices by the authoritative voice of Genè. Our Section was honoured by a copious correspondence of the first zoologists of Asia and America, besides those of Europe, among which it will suffice to enumerate a Müller, a Heckel, a Strickland, an Owen, a Geoffroy St. Hilaire, and above all an Oken, who wrote to express his strong feeling of regard for Italy, and the interest he took in our annual Scientific Congress.

Observations on the Development of the Echinidæ (Echinus esculentus). By M. Dufossé.

I have ascertained that all the eggs contained in the ovary of the *Echinidæ* may be artificially fecundated, by placing some of the points of their testaceous membrane in contact with a drop of semen and of sea-water sufficiently renewed. The duration of the embryonic life of the Echinus seemed to me to vary from twenty-four to

forty-two hours, according to the temperature, and various other circumstances. From thirteen to fifteen minutes after the impregnation, the vitelline mass is seen most commonly to vibrate and become animated with a more or less rapid rotatory motion. From the fourth to the sixth hour the vitellus begins to divide, and the segments which result from this division become more and more transparent. Then a number of little globules are produced on the surface, from the large globules, subsequently surrounding them completely, and thus constituting a pretty thick layer. When this layer of globules, which is the rudiment of the tegumentary envelope, is extended to the whole of the vitelline surface, the embryo has nearly acquired the form under which it will issue from the egg. The vitelline membrane, very distinct during the first period of the division, has completely disappeared, and the albumen, at first opaline, has become as transparent as sea-water. Soon after, the tegumentary surface of the embryo is covered with filiform appendages, of extreme tenuity. Generally towards the twenty-fourth hour, but sometimes a little later, the embryo agitates its appendages with a great velocity, which have acquired sufficient force to serve it as locomotive organs. The animal then soon divests itself of the testaceous membrane of the egg.

At the moment of hatching, the larva of the Echinus has a form very analogous to that of the *Medusæ* and the *Radiata* in general. Its body is rounded like that of the adult animal, presenting simply, at one point, a slight concavity, in the centre of which is the outline of the mouth. That portion may be distinguished whose degree of development is more advanced than other parts of the body, by the name of *oral pole*. By the aid of its filiform appendages the larva moves with tolerable facility, and almost always revolving upon itself. In the sixth or eighth day the form of the animal is modified; half its body, that where the anus is situated, and which may be termed the *anal pole*, is a little elongated. The surface of the exterior envelope has become more compact and transparent; the large globules which were in the centre of the body have disappeared. We then observe the first rudiments of the intestinal canal, in which a short œsophagus is distinguished, a stomach having the form of a large ampulla, and a very short intestine. About the twelfth or the fifteenth day, the body of the larva has become completely pyriform; the circumference of the anus presents little discs forming a sort of small rosette, and deep circular lines are seen on the portion of the tegument comprised between the two poles; the dimension of the oral pole has considerably increased, and we now perceive, around the mouth, appendages analogous to labial tentacula.

Arrived at this stage of development, that is to say, towards the sixteenth to the eighteenth day, the larva of the Echinus, which has lost all its agility, attaches itself, by the anal pole, to the body near which it has rested; and a cylindrical pedicle of tolerable size, and once and a half as long again as the diameter of the body, is developed very rapidly. Thus fixed on a flexible stem, the young ani-

mal has no other motions than those which are given it by the agitation of the liquid. During this period, small buds are distinguished, arranged in regular rows around the oral pole. Towards the twentieth day spiniform processes are developed on the top of these buds, of a great length in comparison to the bulk of the animal. The calcareous matter already enters so largely into their composition, that the least shock is sufficient to break them without making them bend.

I have followed the progress of the animal up to the moment when it is detached from its pedicle, doubtless to live under the form which it retains during the rest of its existence. However incomplete may be my observations, I think that they may give a general idea of the development of the Echinus, and allow us to draw from them the following deductions:—From the moment when the embryo has a form of its own, all the parts of its body are arranged almost symmetrically around the *bucco-anal* axis, and, consequently, it bears in the highest degree all the characters of the type of the zoological class in which it is arranged, that is to say, of the radiate type.

It is around the bucco-anal axis that the activity of the genesic process is manifested from its origin, and is maintained greater during the whole course of the development; and it is principally from the two extremities of this axis that it radiates, and extends gradually to the other parts of the tegumentary envelope.

Search as much as we may, in the arrangement of the different parts of the *Echinus esculentus*, for a tendency to bilateral development similar to that pointed out by M. Sars in an Asteria, not the least trace will be found, even during the shortest duration of one of the phases of the genesic phænomena. In the larva of the Echinus, when the body elongates as well as when it contracts, to return to nearly its primitive configuration, these changes take place in the direction of the bucco-anal axis, so that the radiate form is not at all affected by it. In short, as soon as we can discover the first organic lineaments of this being, it is already a *radiate embryo*, and the animal, in all the other phases of its life, remains invariably *radiate*.—*Comptes Rendus*, Jan. 4, 1847.

Remarks on Opalina Naïdos, *an Entozoon found in the* Naïadæ. By Dr. O. Schmidt.

The very interesting discovery of this entozoon was made in a species of *Naïs* nearly allied to *N. elinguis*, which is furnished with a bundle of hooks at each fourth hook. When the Naïd lies upon its side, a spot in which the oral fissure appears as a notch and the ciliary motion in the œsophageal bulb may be very distinctly perceived. I was looking for the fleshy ridges, which in *Stylaria* I correctly considered to be regarded as forming the tongue, and was delighted on perceiving that a somewhat elongated body situated in the œsophageal bulb, and which was pointed anteriorly, frequently moved nearly as far as the oral fissure, and then, as it appeared to me, was again retracted. I had not expected to find so moveable a

tongue, especially as I had not hitherto seen any trace of it in *Naïs*, and was thus anxiously watching its motions when suddenly the body turned round with ease, and I recognised in it a distinct animal.

It is a polygastric Infusorium, belonging to that genus of which one species occurs so abundantly in the rectum of the frog, but it is somewhat longer, corresponding to the form of the animal within which it lives. It is whitish, entirely covered with cilia, which are only visible when highly magnified, and are regularly arranged in rows. Within it I detected a row of perfectly transparent vesicles. The form of the body is susceptible of various alterations.

After I had watched the motions of *Opalina Naïdos*, the name given to this animal, for about a quarter of an hour in the œsophageal bulb, during which time it was moving forwards and backwards, it turned round near the mouth and receded further into the intestinal canal, in which, at first, I could not detect it. However, it returned several times with the activity peculiar to these animals, and which was not in the least impeded by the ciliated epithelium of the intestinal canal.

My sight however had become more acute during the period of observation, and hence I soon detected it in the middle of the Naïd and among several other individuals, all of which were in active motion. The circumstance that *Stylaria* and *Naïs*, according to Müller's and my own observations, take up only finely-divided nutritive matter, is so completely opposed to the supposition which I myself made of their being Infusoria which had been swallowed, that it cannot be entertained.—*Müller's Archiv*, 1846, part iv.

On the Formation of Cylindrical Masses of Snow in Orkney.

To Richard Taylor, Esq.

Sandwick Manse by Stromness, Feb. 11, 1847.

My dear Sir,—A curious phænomenon in this parish has astonished and perplexed all, and filled the superstitious with no small degree of consternation. Since the 6th inst. we have had hail- or snow-showers, on the 9th snow-drift, and yesterday a slight thaw with frost again in the evening.

During the night a heavy fall of snow took place which covered the plain to the depth of several inches. Upon this pure carpet there rest thousands of large masses of snow which contrast strangely with its smooth surface. A solitary mass may be seen in a field, but in general they occur in patches from one acre to a hundred in extent, while the clusters may be half a mile asunder, and not one mass to be seen in the interval. These fields appear at a distance as if cart-loads of manure had been scattered over them and covered with snow but on examination the masses are all found to be cylindrical, like hollow fluted rollers or ladies' swan-down muffs, of which the smaller ones remind me, from their lightness and purity, but most of them

are of much greater dimensions and weight than any lady would choose to carry, the largest that I measured being $3\frac{1}{2}$ feet long and 7 feet in circumference. The weight however is not so great as might be expected from the bulk; so loose is the texture, that one near this house which was brought in and weighed, was found to be only 64 lbs., though it measured 3 feet long and $6\frac{1}{2}$ feet in circumference. The centre is not quite hollow, but in all there is a deep conical cavity at each end, and in many there is a small opening through which one can see, and by placing the head in this cavity in the bright sun, the concentric structure of the cylinder is quite apparent. So far as I am yet informed, they do not occur in any of the adjoining parishes, and they are limited to a space of about five miles long and one broad. They may occupy about 400 acres of this, and I counted 133 cylinders in one acre, but an average of a hundred would, at a rough computation, yield a total of about 40,000.

Now the question naturally arises, what is the origin of these bodies? I believe the first idea was that they had fallen from the clouds, and portended some direful calamity, and I hear an opinion that one had fallen on a corn-stack and been broken to pieces. It is a pity to bring down such lofty imaginations, and to deprive these cylinders of their high descent, but I prefer truth, when it can be discovered, to the loftiest theory. I must at once, then, set aside the idea that they fell from the atmosphere in their cylindrical form, as the first one I examined satisfied me that its symmetry and loose texture must have been immediately destroyed on coming in rude contact with this earth.

Farther observation has convinced me that they have been formed by the wind rolling up the snow, as boys form large snow-balls. This is proved by examination of the *bodies themselves*; their round form, concentric structure, and fluted surface all show this mode of formation. Again, it is proved by their *position*: none are found on the weather side of hills or steep eminences, where the wind could not drive them up, nor close to leeward of any wall or perpendicular bank from which they seem to have originated—the nearest well-formed small ones being 60 yards to leeward, and the large ones 100 yards. All nearer than this are fragments that have not gone on to completion, but broken down in their passage, and the different portions of the wreck form the nuclei of others. Many however are found blown to the windward side of walls or over the lee side of banks. Indeed, they are found almost exclusively on the leeward side of hills and eminences, where both the wind and declivity assisted in rolling them along, or on plains so exposed that the wind alone operated without the declivity.

I shall only add, that this mode of formation is proved by the *direction* in which these cylinders lie. The wind has been from the north for four days, and I believe that it was so all night, when I am told it blew strong. Now they are all lying with their ends east and west, and their side to the wind; and farther, in some cases,

their tracks are still visible in the snow for twenty or thirty yards on their north side, from which they have gathered up their concentric coats; and I understand these were still more evident at an early hour before a snow-shower obliterated them in many places.

I am, Sir, yours very truly,

CHARLES CLOUSTON.

METEOROLOGICAL OBSERVATIONS FOR FEB. 1847.

Chiswick.—February 1. Overcast. 2. Slight snow. 3. Cloudy. 4. Cloudy: frosty. 5. Overcast. 6. Slight rain. 7. Overcast: snowing. 8. Sharp frost: snowing. 9. Clear and frosty: intense frost at night. 10. Severe frost: snowing. 11. Overcast: slight thaw: severe frost. 12. Intense frost: clear: severe frost. 13. Clear and frosty. 14. Rain. 15. Cloudy: boisterous. 16. Overcast: rain. 17. Fine. 18. Densely clouded: boisterous. 19. Boisterous: fine: clear and calm. 20, 21. Overcast: fine. 22. Hazy: overcast. 23. Hazy and cold. 24. Dry air: clear and frosty. 25. Slight haze. 26. Hazy. 27, 28. Cloudy and cold.

Mean temperature of the month	34°·79
Mean temperature of Feb. 1846	43 ·32
Mean temperature of Feb. for the last twenty years	39 ·55
Average amount of rain in Feb.	1·61 inch.

Boston.—Feb. 1. Cloudy: snow P.M. 2. Cloudy: snow early A.M.: snow nearly all day. 3. Cloudy: snow P.M. 4. Fine. 5—7. Cloudy. 8—10. Fine. 11. Cloudy: snow on the ground. 12. Cloudy. 13. Fine. 14. Cloudy: rain early A.M. 15. Cloudy. 16. Cloudy: rain early A.M. 17. Fine: rain early A.M. 18. Fine: rain P.M. 19. Stormy. 20—23. Cloudy. 24. Fine. 25. Cloudy. 26. Cloudy: snow early A.M. 27. Fine: snow P.M. 28. Fine: melted snow.

Sandwick Manse, Orkney.—Feb. 1. Snow: clear. 2. Snow: clear: frost: clear. 3. Bright: thaw: drizzle. 4. Damp: drizzle. 5. Showers: lightning. 6. Hail-showers: aurora. 7. Hail-showers: snow-showers: aurora. 8. Snow-showers: aurora. 9. Snow-drift. 10. Sleet: thaw: snow: frost. 11. Deep snow*: snow. 12. Deep snow: bright: showers: thaw. 13. Thaw: rain. 14. Sleet-showers. 15. Cloudy: showers. 16. Showers. 17. Showers: rain. 18. Showers. 19. Showers: clear. 20. Cloudy: rain. 21. Bright: showers. 22. Bright: clear: aurora: large halo. 23. Bright: clear. 24. Cloudy: clear: aurora. 25. Clear: frost: clear. 26. Bright: clear. 27. Clear: cloudy. 28. Cloudy.

Applegarth Manse, Dumfries-shire.—Feb. 1. Frost: snow lying half an inch deep. 2. Frost: slight shower: snow. 3. Frost. 4. Frost, but mild. 5. Thaw: slight rain. 6. Thaw: fair. 7. Frost: clear and fine. 8. Frost, hard. 9. Frost: threatening snow. 10. Frost: sprinkling snow. 11. Frost: fine: clear. 12. Frost: sprinkling snow. 13. Frost A.M.: rain P.M. 14. Thaw, soft and fine. 15. Frost, slight: thaw: rain. 16—18. Rain. 19. Rain and sleet: fierce wind. 20. Rain and wind. 21. Fair and fine: thrush singing. 22. Rain early A.M.: cleared. 23. Slight hoar-frost: clear. 24. Frost: clear and bright sun. 25. Hoar-frost. 26, 27. Frost. 28. Frost: clear and fine.

Mean temperature of the month	36°·25
Mean temperature of Feb. 1846	43 ·4
Mean temperature of Feb. for twenty-five years	37 ·2
Mean rain in Feb. for twenty years	2 inches.

* This morning the snow in many places is found rolled up in hollow fluted cylinders, the largest of which measures 3½ feet long and 7 feet in circumference: one which measures 3 feet by 6½ weighs 64 lbs.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse*, Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse*, Orkney.

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. Feb.	Max.	Min.		9 a.m.	9 p.m.	9¼ a.m.	8¼ p.m.	Max.	Min.		Max.	Min.	9¼ a.m.	8¼ p.m.								
1.	29·750	29·601	29·30	29·67	29·83	29·96	30·06	40	30	35	38½	30½	36	32½	n.	calm	ne.	ne.				·23
2.	29·813	29·785	29·58	29·90	29·90	30·13	30·10	36	31	35	39½	27	34	32	n.	calm	nne.	calm	·02			
3.	30·052	29·821	29·63	29·94	30·00	30·05	30·04	37	30	35	38	28	34	36	ne.	calm	nne.	calm				
4.	30·151	30·119	29·82	30·03	30·08	30·06	30·02	39	22	33	39½	29	40	43½	n.	calm	nne.	wnw.				·31
5.	30·141	29·976	29·80	29·90	29·71	29·69	29·52	35	32	35·5	45½	27½	44	41½	w.	calm	s–w.	wnw.	·02			·17
6.	29·683	29·565	29·26	29·40	29·44	29·26	29·53	51	30	41	45½	39	38½	28½	sw.	w.	wnw.	n.	·02			·18
7.	29·574	29·448	29·20	29·40	29·43	29·47	29·45	35	17	32	35	28	25½	27	n.	calm	nnw.	n.			0·05	
☾ 8.	29·653	29·326	29·30	29·44	29·25	29·36	29·25	30	05	25·5	34	19½	25½	28	sw.	w.	w.	nw.				
9.	29·419	29·358	29·09	29·20	29·21	29·33	29·50	34	04	25·5	35½	21	30	33	w.	w.	nw.	n.				
10.	29·566	29·460	29·25	29·44	29·52	29·53	29·69	36	22	25	...	26½	37	34	w.	w.	nnw.	n.				·27
11.	29·862	29·673	29·43	29·60	29·70	29·77	29·78	40	06	31	41½	...	33	35	n.	calm	nw.	n.				
12.	29·887	29·869	29·55	29·63	29·74	29·75	29·78	37	09	30	39	22	32	39	sw.	calm	nw.	w.				
13.	30·026	29·882	29·73	29·80	29·50	29·68	29·16	40	16	24·5	39	19½	38	38	sw.	calm	nw.sw	s.	·26		0·25	·40
14.	29·660	29·604	29·24	29·30	29·37	29·15	29·15	45	39	40	48	36½	40	38½	sw.	w.	w.	wsw.	12	·87		·39
● 15.	29·540	29·358	29·15	29·19	29·18	29·08	28·94	54	34	36	47½	35	40½	42½	w.	s.	sse.	w.	·25			·25
16.	29·798	29·636	29·34	29·39	29·30	29·00	29·13	51	40	39	45½	35½	43½	41½	sw.	w.	sse.	ssw.	·23	·17		·27
17.	29·904	29·879	29·43	29·44	29·38	29·13	29·26	57	47	45	48	37½	44	41½	sw.	w.	ssw.	s.		·03		·09
18.	29·908	29·769	29·38	29·40	29·37	28·93	28·93	51	41	51	50	44	46	45	sw.	w.	s.	wsw.	·01			·41
19.	30·197	29·769	29·35	29·50	29·83	29·25	29·67	49	32	42	44	35	41	42½	nw.	w.	nw.	wnw.		·06		·16
20.	30·235	30·213	29·75	29·92	29·80	29·91	29·62	52	41	42	46	36	42	42	sw.	w.	s.	ssw.	·01		0·87	·07
21.	30·279	30·235	29·79	29·93	30·08	29·86	30·00	51	41	47	57	43	45	44½	sw.	calm	sw.	wsw.				·20
☽ 22.	30·297	30·259	29·90	30·11	30·18	30·21	30·30	46	39	42·5	47	37½	44	39	sw.	calm	w.	se.				·08
23.	30·255	30·209	29·91	30·13	30·10	30·27	30·21	42	27	40	48½	36	42	40	e.	se.	e.	se.				
24.	30·197	30·098	29·95	30·10	30·08	30·20	30·23	41	27	35	44½	32½	40	35½	e.	calm	e.	ese.				
25.	30·136	30·108	29·86	30·05	30·05	30·23	30·21	40	21	32	41	25	39	39	ne.	calm	e.	e.				
26.	30·124	30·063	29·78	30·08	30·10	30·26	30·28	39	25	36	40	30	40	36	ne.	ne.	e.	sse.				
27.	30·100	30·076	29·85	30·12	30·12	30·31	30·34	35	28	33·5	40½	31½	35	38	e.	calm	e.	ne.			0·00	
28.	30·229	30·197	29·98	30·20	30·28	30·41	30·45	38	32	34	43½	31	41½	39	e.	calm	e.	calm		·08		
Mean.	29·940	29·829	29·55	29·775	29·733	29·722	29·735	42·17	27·42	35·8	42·7	31·1	38·25	37·58					0·94	1·21	1·17	3·48

THE ANNALS

AND

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XXXII.—*Further Observations on the Formation of the Flints of the Upper Chalk, with Remarks on the Sponge Theory of* Mr. Bowerbank. By J. Toulmin Smith, Esq.

It is well remarked by Bacon*, that, "if every intellect of every age could assemble and labour in united and transmitted union, but little progress could ever be made in science by the method of *anticipation*." And in another place† he tells us what he means by this "anticipation" (which term he uses as the opposite to "interpretation‡," or true generalization), when he says, "There are two ways of seeking truth. One jumps from a few individual facts to general axioms, and makes use of such axioms in all other individual and mediate cases; and this is the way hitherto in use. The other draws axioms from facts also; but it is by going gradually up from one to the other, by slow steps, until at length the general axioms are reached; and this is the true though untrodden way."

Sir J. W. Herschel says§,—"Whenever we perceive that two or more phænomena agree in so many or so remarkable points as to lead us to regard them as forming a class or group, *if* [there is much in this *if*]—if we lay out of consideration, or abstract, *all the circumstances in which they disagree*, and retain in our minds *those only* in which they agree; and then, under this kind of mental convention, frame a definition or statement of one of them in such words that it shall apply equally to them all, such statement will appear in the form of a general proposition, having, in so far at least, the character of a *law of nature*." A law of nature may perhaps be defined as being a proposition announcing that a certain class of individuals agreeing in *one* character agree also in *another*.

What is necessarily implied in the very term "law of nature," and in the language of Bacon and Herschel? Obviously that there exists no single thing or fact in nature which is simply and

* Nov. Org. Scien. lib. i. § 30 (ed. Lugd. Bat. 1645).

† *Ibid.* § 19. ‡ *Ibid.* § 28. § Preliminary Discourse, p. 98.

independently existent in itself; which does not stand in the relation of *necessary connexion* with some other thing or fact in nature. The recognition of this as a primary axiom certainly lies at the bottom of all science and of every attempt to discover truth. If truth or science has any existence, and is not a mere vain search, every question must really assume this form:—Given the thing or fact before me, with what other thing or fact does it stand in necessary connexion or relation? Abstractedly few men will deny this; but practically it is neglected every day. It is now as it was in the time of Bacon, that the reasoners by "anticipation," they who "jump from a few individual facts to general axioms, and make use of such axioms in all other individual and mediate cases," are most common; the important *if* of Sir J. Herschel is forgotten. Were not this the case, we should never hear, as we continually do, of exceptions to laws of nature. Every one would feel, at the very beginning of and throughout his investigations and attempted generalizations, that in facts of nature there is a necessary connexion, or there is not. If there is, no exception can exist; for the statement of such exception involves a contradiction, viz. that there is *not* a necessary connexion.

Every process of true induction must depend upon the exercise of three different mental operations:—comparison of similitudes (or analogies); of dissimilitudes, or points of disagreement; and, lastly, inferring a necessary connexion between the existence of and relations common to the things or facts compared. Most men are caught by analogies; on these frame theories—"*anticipations*;" with a distorted axiom thus obtained they view every fact subsequently seen, caught, in each, by its similitude, disregarding its dissimilitudes, and so never arrive at a true "*interpretation*." Talk to such men of the very first principles of reasoning, of the primary axiom of "necessary connexion," or, as the same thing may be stated in other words, of the universal laws of unity and design, and they grow impatient. No wonder at it: the constant application of those principles must upset many a theory. Every one who has considered this subject will feel it to follow as a necessary corollary from the principles above indicated, that the existence of a single real dissimilitude must upset any assumed law, generalization, or theory, previously made upon observation of ever so many similitudes. Thus, had it been announced as a law that all transparent solids exhibit periodical colours, it would have been upset, and therefore proved false, by the discovery of a single case in which a transparent solid did not exhibit such colours. Again, though it had been observed a thousand times, and in a thousand different ways, that water decreases in dimension as heat is with-

drawn, and that had been announced as a general law of nature and necessary connexion, yet the very first case in which it was observed that below 40° Fahr. an increase of dimension takes place would have proved the above generalization* to have been an "anticipation" merely.

The reader will feel the exact pertinence of the above observations to the subject immediately before us. The problem is—The Flints of the Upper Chalk: what are the necessary connexions of these in character, mode of formation, &c.? and the point is to explain, upon a general and *universally applicable* principle, the presence, in all its forms, of flint.

To this problem Mr. Bowerbank has offered a solution, namely, "that the common tuberous flints, the horizontal tabular flints, and those forming perpendicular or oblique veins, were ALL produced by the same agency, namely, in all cases, from sponges of which those flints occupy the exact places." I deny that this is a solution of the problem; and, having the principles above glanced at before my eyes, suggest at the beginning of my argument† that, if it can once be shown to be impossible, in any one particular instance, to explain the presence of flint on this theory —if flint is ever, or may be even in a single instance, found elsewhere—the theory ceases to be an explanation of the phænomena, and becomes of no value to the philosophical inquirer; that it is proved to be not an "interpretation," but an "anticipation" merely. To this Mr. Bowerbank replies‡ (instead of re-examining my facts, and ascertaining whether they really are the exceptions I allege) by saying, "This is so richly dogmatical, that one cannot suppress a smile." I have shown that constant regard for such "dogmas" lies at the very foundation of all scientific investigation. Exact science depends wholly on them; natural science becomes more exact by how much such "dogmas" are continually observed. Without attention to them there can be no such thing as *science*; all will necessarily result in mere *empiricism*.

Among the numerous services rendered to science by Professor Owen, none has been more important, as it seems to me, than the distinction he is perpetually enforcing, both in print and in the lecture-room, between *analogy* and *homology*. That distinction, without attention to which comparative anatomy can be no

* In two articles, "On the Discovery of Truth," and on "The Inductive System of Philosophy," in the 'Christian Review' (Boston, U. S., vols. iv. and v., 1839 and 1840), I have endeavoured to point out the importance and universal application of the principles of investigation above glanced at.

† See this Magazine for January of the present year, pp. 3 and 10. I would also refer the reader to the bottom of p. 9 and top of p. 10.

‡ *Ibid.* for April, p. 251.

science, but mere empiricism, is founded entirely upon the strong-felt necessity within Professor Owen's mind of continually being guided by such "dogmas" as many of his predecessors have perchance regarded only with a smile. If, on view of an analogy, inquirers would ask themselves whether, in the two or more cases before them, they can for *analogy* read *homology*, they would save vast confusion in science and promote vastly the discovery of truth. Such was my aim in reminding the reader of the "dogma" which has excited Mr. Bowerbank's smile. Numberless illustrations, without the guide of this principle, would have been valueless; with it, any one becomes sufficient.

Every one knows that sponges are found, among other things, in flints. It is the announcement of this as an explanation universally applicable to the origin and cause of the formation of ALL flints which is the point. I have undertaken to show that that theory is a mere "anticipation," founded only upon a few vague and very loose and casual analogies; and that it affords no true "interpretation" of the phænomena, for that the mass of real facts is full of "dissimilitudes." Mr. Bowerbank has professed to reply to my observations; and the fact that he has done so shows the importance of having the matter thoroughly sifted, in order to get at the truth.

Mr. Bowerbank has, however, not replied to my observations. He does not appear, indeed, to have read my former paper through, as the greater part of my arguments are left wholly untouched, and he has, in very many cases, represented me as saying that which I nowhere say—in many cases the exact reverse of what I do say*. In other and numerous instances, the issues raised and discussed by him are wholly immaterial. I pass by the very distinct intimation, more than once so complacently given, of my hardy ignorance; as that is a mode of meeting an argument sanctioned by such long prescription, that it cannot fail to have its due effect on every candid reader.

In order to save needless length, I shall now show,—1st, in what cases I have been misrepresented or unread; 2nd, in what cases immaterial issues have been raised; 3rd, what arguments have been left untouched; 4th, the unsatisfactory explanations attempted of the facts named and of the specimens figured in my former paper; 5th, some further illustrations which occur to me explanatory of the formation of flint.

1. I certainly did not conceive it necessary to add an interpretation clause to my paper, giving the reader credit for at least understanding that when I used one word, I meant something

* I beg to refer the reader, for some admirable remarks on this tendency and its mischiefs, to Dr. A. Combe's "Letter to Dr. Forbes," in the 'Medical Review' for Jan. 1847.

akin to such definition as would be found in Johnson's Dictionary; at any rate, not exactly the opposite. Thus, when I named "*peculiar* affinity" (p. 3), I meant "belonging to one to the exclusion of others" [Johnson's Dictionary]. When I used the word "envelope," I meant inwrapping and surrounding, and not mere attachment to, or growing upon, as Mr. Bowerbank understands it (see p. 255).

I nowhere deny the predisposition of sponges for silex; on the contrary, I expressly allude to it several times (see p. 10, &c.). I deny the "peculiar" and "special" affinity only, which the sponge theory requires. The very next clause to that quoted is, "Such facts disprove the alleged *special* affinity." Mr. Bowerbank himself admits (p. 259) that I do not deny what on p. 251 he says that I do deny; thus admitting that the whole discussion raised on the latter page is immaterial and unfounded.

Again, it is said that I do "not offer the slightest explanation of the cause of the suspension in all parts alike of the masses of siliceous spiculæ, the remains of polythalamous shells, small branched corals, and numerous other animal bodies; nor account for the continually recurring presence of that tissue which he (Mr. Bowerbank) has described as, and still believes to be, portions of the skeleton of the sponge, to which the great mass of chalk flints owe their origin." Now any one who has read my former paper will find every one of these questions discussed, both as to the fact of their alleged presence, and as to the probable explanation where present (see pp. 4, 15, 16, &c.). The explanation offered by Mr. Bowerbank himself, in his paper in the 'Geol. Trans.,' p. 183, is clearly untenable, requiring as it does the integrity of the entire sponge tissue, *an integrity which has never yet been found to exist in a single instance.* On the same page (252) I am represented to have described two specimens quite differently from my actual expressions, arising from inattention to the grammatical connexion of my sentences; and am further said to offer no explanation of the fact of the position of certain shells on flint, while on the very page referred to I make an express reference, by note, to an explanation in a later page, which explanation is consistent with all known facts, though it happens to be in direct antagonism with the sponge theory. On the same page I am said to speak of a "nodule of water," an absurdity which is certainly nowhere to be found in my paper.

On page 253 I am represented to consider as "very improbable," and to indulge in certain "fallacies of imagination" respecting, certain habits of sponges, which are so familiar to every one that it never occurred to me to be necessary even to allude to them; much less did I doubt them.

On page 254, by citing the first three lines only of a paragraph, I am made to appear to refer to a wholly different and exactly opposite class of facts to that to which I do refer, and my reference to which (p. 5) is left altogether unnoticed. I show that shells are, in flints, found where they could not possibly be found in sponges. Mr. Bowerbank's observations only further show that, in recent sponges, they are actually found in a wholly different place and manner to what they are found in flints. On the same page, by reversing the use of italics, my meaning is reversed. Mr. Bowerbank having alleged, in support of his theory, that one of the orifices of Echinites is *always* found in one position, I show, from reference to individual facts, the erroneousness of this generalization, and therefore of the special inference to sustain which it was made; nor can a smile at the essential dogmas of inductive science lessen the force of those observed facts.

I nowhere deny or dispute, as *throughout* Mr. Bowerbank's paper I am represented as doing, the well-known fact—known to every merest tyro in natural history—that corals and sponges usually attach themselves to and grow upon rocks, stones, shells, and other hard bodies. Such familiar facts it was unnecessary to mention, either for the purpose of my argument or to prevent my being misunderstood. The question is not, to what sponges attach themselves, of which only all the cases cited by Mr. Bowerbank are instances—but (as I have shown, p. 5), what attach themselves to sponges. The cases instanced are moreover cases of attachment, not of envelopment. In the cases of wood, &c. it is really a question of penetration, not only of envelopment. So that in each and every case Mr. Bowerbank has missed the true point, and been arguing only with a chimæra of his own creation. The important distinction between *enveloping* and *attaching to* is throughout lost sight of.

I nowhere suggest, as represented on page 258, the necessity of thermal heat for the formation of flints, nor make the slightest allusion to it.

From smiling at the dogmas of inductive science my meaning is again misrepresented at page 259; my point in the passage cited being simply that, as I could show "some facts of external forms" inconsistent with the sponge theory, the generalization presented by that theory could not possibly be true, no universal law admitting of exceptions.

On page 260 I am alleged to "distinctly recognise the theory of the gelatinous condition of flint," while the three lines just before quoted from my paper most explicitly affirm the reverse; which view—the impossibility of the *gelatinous nature* of the fluid —is throughout and in many places affirmed and endeavoured to

be proved by me. It is quite impossible to be more explicit on the point; and it would be as correct to represent an author writing in support of the animal nature of sponges to be an advocate of their vegetable nature, as thus, and so very little to the point, to misrepresent my language and argument.

On page 260 I am said to suppose the existence of "many minute currents," without any evidence of such supposition from my paper, and in direct opposition to my expressions on page 12, where I speak of the "rare occurrence" of the instances.

The pointing out the erroneous representations given of my language and views of course relieves me from the necessity of noticing at any length the discussions raised by Mr. Bowerbank on the points thus erroneously stated; but the fact of such numerous misrepresentations existing argues little for the soundness of the opposing theory.

2. Nothing is more important in questions of science, as well as of law, than to keep the real question always in view, and not to travel out of the record, and so raise what the lawyers call false issues. By raising always one certain, single and material issue only can the truth be got at. Raising false issues, though very convenient when an argument cannot be answered, serves only to—but at all times it does—obscure the truth and confuse and mislead the reader. The present question is with the flints of the upper chalk*. We have nothing now to do with the siliceous masses and cherty nodules of either mountain limestone or tertiary beds. So, every one being familiar with the fibrous appearance of agates, &c., and with the occurrence of undoubted sponges in the chalk flints, any discussion on either of these is merely leading us astray from the point, viz. a universally applicable generalization as to the formation of the flints of the upper chalk.

It may be very interesting, in a natural history of recent sponges, to inform us of all the modes in which they are found. But, unless it can be shown that they are found in flint as they are alleged on page 253 &c. to be found recent, it is wholly beside the

* In all geological questions, nothing is more important than stratigraphical exactness. A recent instance of neglect of this has occurred which will be a fertile source of error and vain theory. In the second volume of the 'Journal of the Geological Society' is a description of a Pterodactyle, alleged to be from the "upper chalk." Immediately after it appeared (Feb. 1846) I informed the author that this was incorrect, as *no upper chalk whatever* exists in the localities whence his specimens came. No correction has however been made, and it has now gone forth to the whole scientific world, with the authority and sanction of the Geological Society of London (p. viii. of vol. ii. of the Journal), that Pterodactyle remains have been found in the upper chalk, a statement fruitful of future theories, and which is without a shadow of foundation.

mark, and it is unnecessary to travel to Algoa Bay, Torres Straits or Wollongong in search of illustrations. Now it is well known to all familiar with flints, that the latter are never found, and have never been found, having the characteristics here described by Mr. Bowerbank as attaching to recent sponges. It was said of the old Greek philosophers, that, while one made laws for men as they are, another made laws for men as they *ought to be*. So Mr. Bowerbank, having by "anticipation" determined that all chalk flints have been sponges, proceeds to tell us how *recent* sponges are found. Hence we may indeed infer his opinion, that flints ought to be found the same; but, in the mean time, the facts as to the actual mode in which flints are found are altogether lost sight of. With the "habits of the Spongiadæ," such as described on page 253, and figured by Dr. Johnston and others, every one is familiar; but they have nothing to do with the question before us, unless indeed it be to afford another illustration of the utter fallacy of the sponge theory, by satisfying us that there is no true analogy whatever between the flints and any of the illustrations given or cited. Of that fact every one having a moderate acquaintance with flints must be fully aware.

The facts cited on page 254 again, being only adduced to appear to meet a sentence which, in its original connexion, had an exactly opposite meaning to that here given to it, are equally beside the mark, as they are also equally inconsistent with any of the observed phænomena of flints.

I have already shown that the whole discussion on the gelatinous state of the fluid is gratuitous; but I must remark that Mr. Bowerbank involves himself in several contradictions on this point, first ridiculing the idea of one solution preserving any integrity within another* (page 260), and afterwards speaking (page 262) of the "great prevalence in solution in water" of this very substance. Mr. Bowerbank cannot surely but have seen the condition when mixed of fluids of different densities, as oil and water, &c. &c. The specific gravity of the liquid silex is obviously a very material point. But Mr. Bowerbank himself, in his paper in the 'Geol. Trans.,' p. 183, several times mentions the "gelatinous globules," so that his views must have undergone a material change in this respect.

3. But all the material arguments used by me are left wholly unnoticed by Mr. Bowerbank. This silence can leave but one inference. It is proper, that the nature of the discussion may be understood, to enumerate the principal arguments thus unan-

* Dr. Turner expressly alludes to the "tendency of like molecules to get together and adhere while intermixed with a mass of dissimilar matter rendered liquid," and the fact is familiar. Mr. Bowerbank's observations amount, if anything, to a denial of molecular attraction!

swered. On page 3 of my paper is discussed the necessarily implied *peculiar* and *special* affinity of sponges for liquid silex; on the same and following pages, the sparing and fragmentary presence and character of the remains of tissue; on the latter page, the non-existence of any places of roots, and the contrary fact of undoubted sponges being found in which such places are always present. On page 5, not only is the abundance and size of shells, &c. found *within* flints noticed, but the position of the organic bodies found on the exterior of flints is very fully and prominently discussed. On page 6 the condition of certain zoophytes is noticed. On page 7, the important fact that—and it is explained why—shells fixed on Ventriculites are left bare by the flint, and the fact that soft animal matter, and not, as in recent sponges, shells and other hard substances, formed the point of attraction for the flint. On page 8 the phænomena of Ventriculites are more fully noticed. On page 9, the important fact of flint occurring to the same extent without as within the Ventriculite, though with no connexion between them; and, on the same page, the extremely frequent case of flint nodules being found round the roots of Ventriculites, where sponges could never reach, but which places would be peculiarly apt, according to my view of the formation of the flints, to exhibit these aggregations.

The non-sponge character of Ventriculites is also shown on page 9*, and also certain inconceivable phænomena which the sponge theory requires (among many others) to explain the silicification of Ventriculites.

The true nature and character of the specimens figured is described on page 10, &c., and the mode of their formation endeavoured to be explained in detail; and it is proved that the liquid silex could not possibly have been in a gelatinous state, but must, on the contrary, have been in a state of extreme liquidity, and liable to very rapid solidification; which rapidity of solidification is shown to be necessarily inconsistent with the sponge theory, and which Mr. Bowerbank's remark (page 250), on the very enduring character of the horny skeleton of sponges, makes still more evident.

On pages 15 and 16, the modes and forms assumed by the flint nodules† and tabular masses, and the imbedment in them of the various classes of organic remains, are explained, the presence of the fragmentary tissue having been before explained on page 4.

* Mr. Bowerbank's alleged recent Ventriculites (p. 258) have no analogy whatever to the true Ventriculites; nor are his specimens so new or rare as he imagines, the most striking of them being beautifully figured, with others no less striking, on plate 59 of Ellis's Zoophytes.

† See note *post*, p. 308.

Not one of the arguments and points thus enumerated, and minor ones might have been added, is attempted to be answered by Mr. Bowerbank. That fact naturally gives them much additional weight, as his paper is an avowed "reply" to mine, and all that could be answered would assuredly be so:—*Expressio unius est exclusio alterius.*

4. Let us now see how points really touched on, and bearing on the question, are handled.

On page 250 there is an attempt to reconcile the facts of the unequal distribution of the sponge spicula [their "suspension in all parts alike" (see page 252*) is a thing which does not exist]. When I speak of the "destruction of the structure of the sponge," I of course allude to the "tissue" so often named; though, whether this or the gelatinous matter be meant, it is equally certain that its destruction is a necessary postulate of the sponge theory, inasmuch as, if not destroyed, it would be still present; but no single instance exists in which that tissue has been found to pervade the whole substance of any flint; and this must be obvious to every one familiar with the phænomena, notwithstanding that Mr. Bowerbank now "denies totally†" this destruction of structure. It is admitted, in this very passage, that the "horny skeletons are very enduring," and see further page 258. This fact then necessarily implies, what I have shown to be inconsistent with fact, and what the author himself elsewhere now denies, viz. the long-continued gelatinous state of the flint to allow of the decomposition of this tissue to such an extent that only the fragmentary remains we have of it shall be left. Mr. Bowerbank tells us that the spicula exist in the gelatinous substance. Dr. Johnston, on the contrary, describes those spicula as "bound together by a substance analogous to horn or albumen," either in the form of fibre or diffused, this horny matter being the very substance described by Mr. Bowerbank as so "very enduring;" so that the spicula ought clearly to be retained in their position, and not to run away in the poetic manner imagined by Mr. Bowerbank. Besides this, Mr. Bowerbank tells us ‡ that the mealy coating of flints is formed by the penetration

* See also 'Geol. Trans.,' vi. p. 181. This very assumption is also obviously inconsistent with the explanation now offered at p. 250.

† Ehrenberg expressly says of the Paramoudras, that he "*failed* to discover in the interior the structure of well-preserved sponges;" and further, that "the internal structure does not in any way favour this view" of their spongeous origin. This is not an unimportant testimony. See 'Ann. Nat. Hist.,' vol. ii. pp. 161 and 162. In the 'Geol. Trans.,' vol. vi. p. 183, Mr. Bowerbank himself says, that often "no indication of the former presence of the organized structure of the sponge remains." What are we to understand by such contrary and contradictory propositions?

‡ Trans. Geol. Soc. vol. vi. p. 184.

of the surface of the sponge by fine silt, which caused the preservation of form. If such a coating were thus formed, it is obvious that the spicula could not escape in the way represented; and the fact is, further, that spicula are not found specially to abound in the mealy coating, as the explanation offered would, at any rate, render necessary.

I shall presently show, moreover, that Mr. Bowerbank is entirely wrong in imagining that the gelatinous substance was poured out of the sponges before they were enveloped in flint.

On pages 252 and 253 Mr. Bowerbank tells us that the position of such shells as I described on pages 4 and 5 is "quite natural" on the outside of sponges. I answer that it is contrary to every law of gravity and to every fact, and that no illustration of similar facts can be produced among recent sponges. He himself says, just before, that their natural mode of sinking would be to the bottom of the water*. So I say, and beg to refer to the argument on page 5 of my former paper, which has not even been noticed by Mr. Bowerbank. He has shown to me, I must presume, having visited his museum twice for the purpose, all his most characteristic specimens; and I have certainly not seen in his collection, or elsewhere, a single specimen having the slightest approach in character to the specimens described by me on pages 4 and 5. It is indeed obviously impossible that shells could adhere to any sponge in such positions as in the second-named specimen. The fact of those shells being so found is, on the other hand, a beautiful illustration of the mode of formation of flint suggested by me, namely by affinity for a nucleus combined with molecular attraction. On Mr. Bowerbank's theory, these shells ought, of all places, to be covered with the sponge, sponges especially attaching themselves to solid bodies. But the fact is, that instead of the flint "loosely embracing" (page 253) a shell lying on it, as in the cited sponge, the presence of a shell on the surface of a Ventriculite invariably acts as a *repellent* of the flint. The flint surrounds the shell on all sides, tends to lap a little over in a bulging manner, but does not extend over. Why is this? Because the soft body had a peculiar affinity for the liquid silex, the shell had none. Attracted by the soft body, the flint surrounds it—extends as far as the shell; the molecular attraction causes it to bulge a little over the margin of the shell; but the combined nuclear affinity being wanting beyond, it extends but little way. This seems very simple; and as it is the test of a true theory or generalization, that every new fact, thoroughly understood, serves only to illustrate it and make it

* We are not speaking here of such shells as Ostreas and Dianchoras, which affixed themselves by special provisions to surfaces of Ventriculites, &c.

still clearer; while it is that of a false theory or generalization, that new facts cannot, without much distortion, be reconciled; so these phænomena, while negativing in the most absolute manner the sponge theory, beautifully illustrate the mode of formation of flint which I have ventured to suggest.

The reader must again carefully note that we are not, in truth, considering the cases of sponges *growing onto, attaching themselves to, shells*, &c.—such cases as are figured and described in Dr. Johnston's beautiful and most interesting volume. It is notorious, and is not attempted to be denied, that we never do find flints in which a root-place is visible, except in such instances as I have noted on pages 4 and 9. We are considering shells scattered on all parts of the exterior of the flints*.

While on this point, it is proper to notice that Mr. Bowerbank bases his ideas of the sponge growth of the tabular flints (Geol. Trans. vi. 184) on an entirely erroneous view of the nature of these tables. They are, in fact, all made up of *two distinct plates*, as I shall have occasion to notice hereafter†. This alone renders their sponge origin quite untenable.

It is laid down by Mr. Bowerbank on page 255, as it is by Dr. Johnston (page 11), and is no doubt correct, that if one sponge grow over another of different species, they *never unite organically*; and hence he would explain the Wiltshire flints. The empty space there however is too great by far for such an explanation, as the parasite clings close though it does not organically unite. But this explanation is wholly inconsistent with another very large class of facts. For it is more important to observe, that, while Mr. Bowerbank is obliged in another place (page 259) expressly to admit that one species of sponge was so extremely different from another, that, though the inclosed species is often wholly preserved, the incloser is utterly decomposed (notwithstanding the "very enduring" nature of its horny skeleton), the fact is—I speak from inspection of many hundred specimens in my possession—that hardly a single instance, if any one, can be found in which these so different species of alleged sponges have *not* united organically‡; insomuch that it is only by artificial means that the external structure, either outside or inside, of the inclosed object can be detected. One of the two generalizations thus, with equal confidence, announced, must there-

* I do not here dwell on shells inclosed in flints, as they present no difficulty.

† See *post*, p. 308. Ehrenberg, though not noticing this point, felt their sponge origin untenable. See 'Ann. Nat. Hist.,' vol. ii. p. 162.

‡ In a few instances small patches may be found in which they can be separated, but these are extremely rare. The cause of such instances is quite explicable on principles hereafter to be explained, which also explain the Wiltshire specimens. See p. 306.

fore necessarily be false; and none who see the structure of the inclosed object perfectly preserved, while not a trace of the structure of the alleged incloser can be found, can for a moment doubt which generalization must be abandoned.

But we come now to another and most important point, to which I request the special attention of the reader; and I cannot imagine that any one who applies the rules of inductive philosophy to scientific investigation can contemplate the facts I have now to name without at once feeling that the sponge theory is utterly untenable. It is necessarily a postulate of the sponge theory, and is distinctly stated by Mr. Bowerbank (page 255, &c.), that, in every case where a Ventriculite is encased in flint, it is in consequence of the *parasitic growth over the Ventriculite of a foreign sponge.* I have in my cabinet at least 500 specimens (probably very many more) of Ventriculites. I have shown Mr. Bowerbank the greater part of these, and he was not able to point to more than one single specimen (and that very doubtfully*) in which a parasite had not overgrown the original body, and so formed the flint. Now it is not enough to tell us of instances of parasitic sponges, nor yet that certain species are always parasitic. It must be demonstrated that there existed species, having a special and peculiar affinity for silex, which were invariably parasitic; and that there was invariably present silex in precisely sufficient quantity to saturate them. It must further be proved that this species of parasites had the wonderful property of always growing in pairs, one growing inside and the other outside of the invested object, and yet having no possible connexion with each other, though, with very rare exceptions, growing to precisely the same level. It must further be proved that the Ventriculites themselves, unless thus invested, never could become silicified; that, when invested by the parasite, they were always silicified. It must yet further be proved that the parasite, though retaining its form, invariably decomposed utterly before that process commenced in the invested Ventriculite. Further, it has been seen that the law of non-organic union of different species is never observed by these particular species of assumed parasites. This is a pretty long draft on our credulity. Now I request the reader to note that, having before me hundreds of Ventriculites invested with flint, and hundreds not invested with flint, there is not one solitary instance in which any parasitic sponge is found *in the chalk* and unsilicified to surround a Ventriculite; nor is there one single instance in which, the Ventriculite being invested by flint, a trace of the alleged parasite is

* This case really forms no exception. Mr. Bowerbank declares even the specimens named by me at bottom of p. 8 and top of p. 9 to be invested with threads of the parasitic sponge.

found beyond the margin of the flint, as is the case in numberless instances in true sponges. But it is continually found that as well Ventriculites as sponges of many different varieties are preserved in the chalk equally as in the flint, and that without any connexion whatever with Ventriculites, but always themselves again invested with the assumed parasites. It is further to be noted, that there is not a single case in which a Ventriculite or sponge is found silicified in a normal form, i. e. *without* an assumed parasite; nor, further, a single case in which either Ventriculite or sponge is found inside the assumed parasite in the unsilicified state in which each is so often found in the chalk, and with the body or extended threads of the assumed investing parasite alone silicified. What an extraordinary tissue of contradictions is then involved in this theory! Had such parasites existed, no one can doubt that they would have been often found investing Ventriculites and sponges in the chalk and unsilicified; and, further, that Ventriculites and sponges would have been found silicified indifferently with or without parasites, as well as unsilicified within the silicified parasite. The doctrine of chances, which is but another name for the laws of unity and design and the principles of induction, is at an end, if, to prop up a theory, we are called upon to accede to postulates thus monstrous and contradictory, but absolutely necessary if the sponge theory is to be sustained.

I have alluded in my former paper to the frequent flint nodules formed round the roots of Ventriculites. To my no small surprise Mr. Bowerbank showed me a specimen of this kind, removed at the lower part from the chalk; and pointed to the orifices through which the roots passed as proof that it had been disrupted, and as great excurrent canals. I expressed my astonishment as strongly as courtesy would permit. I stated that I would engage that the assumed excurrent canals would, if cut open, show roots of Ventriculites. Mr. Bowerbank, however, insisted on the excurrent canals. Now, having hundreds of like specimens in every condition, the true facts are so familiar to me, that I can only be amazed at this as an extreme instance of the lengths to which "anticipation" will lead a man to overlook the most obvious facts in support of his theory. Mr. Bowerbank, moreover, insisted to me that, where flints were formed round roots of Ventriculites, the latter must have been disrupted and lying on their sides; remarking that it must be so, *because* otherwise the sponge could not have grown round the roots, which, normally, struck into the mud. This is indeed arguing in a circle. I admit the latter part of the position, namely that no parasitic sponge could have grown into the mud and so invested the roots; and, because it is so, I again assert that these flint

nodules never were sponges. For I am prepared to demonstrate to any one who will favour my cabinet with an inspection, that the Ventriculites thus invested as to their roots were *not disrupted*, but, on the contrary, were growing normally and *in situ* when invested by the flint: and the great specific gravity of the flint readily accounts for its sinking into the soft mud so as thus to invest their roots. It is further obvious, that had they been, as alleged, disrupted and lying on their sides, the accumulations of flint would be all on one side, they forming merely the attachments of the sponge; whereas the fact is, that the general rule is a pretty equal distribution of flint all round. If a special mass lies on one side, it is capable of explanation.

My space warns me that I must hasten to notice the explanations attempted of the figured specimens.

Mr. Bowerbank would have us believe (page 257) that the woodcut (page 11) is explained by the flint being "the remains of one of the large internal canals of the sponge." When the reader is reminded that this is an assumption of a *petrified mass of revolving water* (revolving, too, normally, after all the rest of the sponge has utterly decayed), it cannot be necessary to notice the suggestion further.

I noticed Mr. Charlesworth's silicified pulp-cavity with a reservation. I have seen the specimen. There are undoubted polythalamia in it, though not such apparent sponge tissue. For the reasons named in my former paper, I see no difficulty in accounting for the presence of the minute polythalamia, though very great in imagining the growth of any sponge in such a locality. As to my own figured specimen of jaw, I certainly was not then, nor am I now, aware that the substance of the teeth and jaw is silicified, but know the reverse to be the fact; and when the reader learns that the teeth in that specimen are anchylosed to the jaw, which is solid below them, he will feel that no "space intervening between the tooth and its socket" ever existed. But Mr. Bowerbank's attempts to explain figures 1, 2 and 3 are the most extraordinary. The condition of figure 2 is so fully explained in my former paper as at once to refute the notion of an "accident during the elevation of the chalk,"—a notion under any circumstances so far-fetched and, on every ground, inadmissible, that it cannot be necessary to combat it. Mr. Bowerbank cannot, however, have read the description of this specimen. As to fig. 3, of which it is most gratuitously said (page 259) that some of the fragments "appear to have been shells," in direct opposition to the fact, Mr. Bowerbank is compelled to admit that the fragments are "fragments of older flints," which is just what the specimen was engraved to show, and which Mr. Bowerbank leaves wholly unexplained. As to figure 1, I cannot at all under-

stand the statement that it "exhibits an appearance of having been deposited in concentric layers, which are exposed by what seems to have been an irregular decomposition of its surface." I beg, in the most explicit manner, to say, that not the slightest appearance of the kind, in any respect whatever, is presented. Let the reader glance over the description given on page 11 and examine the plate, and he will at once see that the actual appearances are the most directly opposite and reverse of the alleged appearances. The decomposing flints alluded to are not very rare; but in every respect whatever they totally differ, both in external aspect and internal appearance and arrangement, from the specimen described, of which all the edges are perfectly sharp, the substance perfectly hard and in the highest state of integrity, and the *horizontal*—and no trace of concentric—layers very visible in some places. I have since obtained other fine specimens of the same kind, all in an equal state of integrity, and all therefore equally conclusive against the sponge theory.

Mr. Bowerbank is much distressed at the idea of "currents and whirlpools." If I gently give motion to a jug of water at a given temperature, the whole mass assumes a form, as stated in my former paper, very much like that on these specimens, and the necessary "currents" excite no marvel. The motion among the particles themselves causes the angular ridges. It is only when the mass assumes special forms, as in fig. 1, that some special motion must be suggested. Now I can show that such slight, but sufficient, motions took place in the region of these phænomena, having been at the pains to collect specimens for the purpose of establishing the point. Thus all the difficulty vanishes. There are no "contrary currents in opposition to the figured side," but precisely the reverse, as stated in my former description of the specimen.

As to the last-named specimen (fig. 1), it may not be amiss to state that, as if to afford direct evidence of the truth of the views advanced by me in explanation of the phænomena exhibited by that and similar specimens, I have been fortunate enough, since that paper was written, to obtain a specimen exactly similar to the part *a* in fig. 1, *in the chalk*. This proves the existence of an absolute cause in that ocean sufficient for the production of such forms. Now it is particularly interesting to find that, in this chalk specimen, immediately underneath the chalk surface, which was cleared from the block by my own hand, there is a layer of flint—a capsule fitting into but below it, so that the chalk impression is no mould, but a cap. This is beautifully consistent with the suggested cause of the solidification of flint under such circumstances, viz. the given motion. It further suggests how the chalk impression remained firm after the mo-

tion which caused it had ceased, the rapidly solidified flint compressing it.

5. Space will not allow me to add many of the additional illustrations which crowd upon me. Several fresh facts have been already named. I will therefore conclude with a brief notice of two most important facts in the natural history of flints and their inclosed bodies, which, by an extended series of preparations, I have ascertained since my former paper was written. Each of these points has furnished me with direct evidence of that which I had before inferred, as most probable, from collateral facts only. Each equally demonstrates the fallacy of the sponge theory, and points to important truths in the natural history of flints. As I propose to take an early opportunity of detailing the observations relative to the first point alluded to, I will only call attention here to the general result.

Flints are generally considered in the light of homogeneous masses, mineralogically the same throughout each individual mass, except in such cases as Mr. Bowerbank notices on p. 257, and which notice by him shows that he is not aware of the facts which I have now to state*. Indeed had he been so, the sponge theory could never have been framed. Mr. Bowerbank speaks (p. 257) of chalcedonic crystallization "wherever there has been a small space originally *not* occupied by spongeous substance;" and at p. 250 he evidently implies that silicification took place after all animal matter had drained out of the horny skeleton; and at p. 258 he cannot understand any reason for imagining the Ventriculites to have been imbedded in flint while alive. His remarks also, in this and other papers, upon agates, equally show his opinion that the chalcedonic crystallization took place *only* in spaces "originally *not* occupied by spongeous substance." Now I am prepared to show that, confining ourselves to the *flints* of the upper chalk, our true point, the exact converse of this is true, and that the places in which chalcedonic crystallization has taken place are places which *were originally occupied by the spongeous or other* animal substance†. I will not at present absolutely affirm that in no other cases is chalcedonic crystallization found, though I believe such to be the case. It is enough for my present purpose if I can clearly show that this chalcedonic crystallization is present in numberless instances in perfectly

* Nor are these phænomena noticed in Brongniart's 'Essai sur les orbicules siliceux;'—their possibility being indeed expressly put out of the category. See pp. 21 and 23 of that 'Essai.'

† It will be understood that I mean to express this as *the ordinary cause* of hollows in chalk flints, which Mr. Bowerbank nowhere explains. Elsewhere (in volcanic rocks, &c.), hollows existing from other known causes, siliceous infiltration and crystallization would obey the ordinary laws.

solid flints, and that, in all such cases, I can demonstrate the origin of the space it occupies. In my former paper several facts were named (pp. 4, 7, 8, 9, 16, &c.) showing that the places of the soft parts of animals had been penetrated by silex. I felt however and admitted a difficulty in fully explaining this. That felt difficulty led me to make a long series of preparations, which seem to have at length cleared up the point and thrown much light on the whole formation of flint.

If a section of moderate thickness is properly taken from a flint in which experience teaches the observer that a Ventriculite or true sponge has been inclosed, it will be found, in holding the specimen up between the eye and the light, that a part of it, having a very defined outline, is much more transparent than the remainder. On examining that more transparent part under an inch achromatic, traces, more or less distinct, of crystallization will be obvious. Continued and extended observation—the means of which I shall be most happy to supply to any who may feel interested in the question—is necessary to realize the result, which will however in the end inevitably be the conviction that those lighter shades are the places formerly occupied by the soft parts of animals or sponges once inclosed—in a living or undecomposed state—in the flint which had suddenly and solidly encased them in an amorphous condition; that the soft parts first, and afterwards the firmer parts, of those animals subsequently decomposed, *leaving*, in the *then solid flint which encased them, a hollow mould of the exact form of the living animal*; that subsequently to this it was that silex, suspended in a gaseous or liquid form (I incline to think the former the more frequent *), found its way into these then hollow spaces and there crystallized †; that, where any of the firmer fibrous parts happened to remain, they served as nuclei round which crystallization formed; that if the silex were thus presented in sufficient abundance, it gradually filled up the entire hollow space, leaving a perfectly solid flint; if not so abundant it crystallized round the remaining fibres only, presenting us with those open reticulations of such exquisite beauty with which carefully-made sections have most amply rewarded my labours in the course of these preparations.

* Mr. Bowerbank's objection (p. 258) to thermal heat is unfounded. Shells, &c. may be subjected to a greater heat than that necessary to suspend the silex in a gaseous state without danger. Dr. Mantell has reprinted some interesting experiments on the suspension of silex in steam, and, though this does not seem *necessary*, the permeation of rocks by heated gases is so well known, that it presents perhaps a more obvious general (not universal) explanation of the gradual accumulation of the matter than any other hypothesis.

† The note (p. 6) applies in all these cases. If there were no orifice, neither could gases of decomposition escape nor the chalcedony enter. The place of the original orifice may always be found, either marginal or radical.

In Dr. Turner's lecture (p. 27) he says, "The development of regular crystals was owing to the extremely slow progress of the same process which, when less slow, might cause the deposits to be amorphous." This precisely accords with the view suggested of the rapid solidification of the amorphous flint round the living animal, and the slow deposit of the crystallized silex * in the subsequently present hollow space.

Of course cases occur in which other substances besides chalcedony have insinuated themselves into the hollow. Such cases—the line of division being equally marked—serve only further to illustrate my position. In the majority of cases however it is chalcedony.

To these observations on this first point I will add nothing more at present but the remark, that the suggestion offered in my former paper (p. 4) as explanatory of the presence of *fragments* of sponge tissues in many flints has a strong light thrown on it by these observations, and the bearing of these observations on the present question becomes of great importance when those fragments are considered. I there considered them to be torn fragments of the horny tissue. In such case it is clear that none of the gelatinous substance of the sponge would be present. It would be purely and truly a mere fragment of the horny network. Consequently this would be indeed saturated with and imbedded in the flint itself, and, there being no gelatinous mass to decompose, no hollow space would ever be left to be filled with chalcedony. *Hence it is* that around *such tissues* we see none of the semitransparent chalcedony, but simply the dull homogeneous flint. Hence the true nature and origin of those fragments, as suggested in p. 4, is—with the consistency which always attends the examination of new facts by the light of a true explanation of nature—rendered almost demonstrative, and, by consequence, the so-called "characteristic flint tissue" at once placed out of further question and removed altogether from the argument. And yet it is upon the presence of these fragments only that the whole fabric of the sponge theory has been raised! Even the weak analogy which they afforded, and on which the whole "anticipation" rested, seems thus entirely destroyed; and the facts which destroy it appear to increase the light which points with clearness to the true origin of the modes and forms in which the flints of the upper chalk are actually found,

* For convenience this more transparent part may be termed chalcedony, though it is clear that chalcedony and flint are merely different forms of silex, having a differing amount of foreign matter and impurities. The gaseous state of the chalcedony would tend to cause it to have less of the grosser impurities which discolour the flint and render it opake. Hence its general transparency.

as suggested in my former paper, namely, by the rapid solidification of a fluid—induced by special circumstances—combined with its own molecular attraction; those special circumstances being, generally, an affinity for an organic nucleus*; occasionally, mere mechanical action, such as motion taking place where the solution happened to be present. The point before obvious as a fact, but difficult of explanation, of the penetration of soft parts, has now also, I trust, received some elucidation.

The second point to which I would call attention relates, not to the formation of the nodular flints, in which the bodies just considered are usually found, but to a no less interesting and confirmatory fact as to the suggested origin of the tabular flints. I suggested, at p. 16 of my former paper, that "where there was a layer of minute organic bodies, there would be fewer centres of attraction, and tabular flints would be formed." This has been confirmed by facts of subsequent detailed observation. The tabular flints, which extend unbroken over vast spaces, are not found as described by Mr. Bowerbank, 'Geol. Trans.' vol. vi. p. 184, but are formed of two plates united in few places. Between the plates, and totally unconnected with the chalk above or below, is a layer of pulverulent substance, *not chalk*, but which, on submission to the microscope, is found to be made up of most minute organisms—so minute as only to be at all discernible under a quarter-inch achromatic, and only clear under an eighth. These are of a character and belong to genera totally distinct and different from the ordinary microscopic forms abounding in the beds of chalk immediately above and below the several tables, while the latter forms are extremely sparing in this most interesting and remarkable layer. The principal forms in this are extremely numerous and minute Gallionellæ, a minute Navicula, and several other forms. These forms make up the whole mass, or very nearly so. These facts point to phænomena, as to the time and manner of the deposit and depth of the water, which require careful and separate consideration, and on which therefore I forbear now to enter. Their important bearing on our immediate subject cannot fail to be recognised. Not a trace is found on the under side of these tabular flints of the nature described by Mr. Bowerbank (p. 254) as appertaining to flat sponges, while the remarks made by me on p. 5 are most fully borne out. I have had an opportunity of examining a large

* As to the formation of the nodular flints by "separate centres in one mass" (p. 16 of my former paper), this will surely be understood by any one who has watched two or more globules of water or mercury approach and unite. Had they contained organic nuclei, instead of forming fresh and larger perfect globules they would have formed irregular nodules like the flints.

area just cleared of the flat table of flint. It was perfectly flat, as was the upper surface also of the flint removed. No shell of any large size was found on either surface. I observed however in several places on the upper surface lines of much the same character—though occurring for the most part only singly or few—as the lines on the specimen figure 1, and which lines I cannot doubt owe their existence to a slight motion of the water above while the mass was in the act of solidification.

In conclusion I would remark, that, while it has been absolutely necessary for me, in order that some approach might be made to the discovery of truth on this very interesting and oft-mooted question of the formation of the flints of the upper chalk, to show how much my language and views have been misrepresented, and how contrary the facts are to the representations, I would not for a moment be thought to imply any intentional misrepresentation in either respect on the part of Mr. Bowerbank. It is one of the greatest evils of all "anticipation" that it tends to dim the sight and to warp the impression derived from what seems the clearest fact or statement, and that any fancied analogy (I use the word as more familiar than *similitude*) is seized and dwelt on to the exclusion of numberless points of dissimilitude. I trust that the observations of Mr. Bowerbank may serve to advance the discovery of truth in this matter, if they be the occasion of my rendering more clear the facts and reasons which appear to me to demonstrate the existence of numberless dissimilitudes between the facts of nature and the generalization hazarded by him, and of enabling me to render also clearer the suggestions which I have ventured to throw out, and which I would fain hope tend to elucidate in some degree the natural history of the formation of the flints of the upper chalk.

XXXIII.—*Descriptions and Notices of British Shells.* By J. Gwyn Jeffreys, F.R. & L.S.

It was my first intention to have reserved for the work on British Mollusca, in which my friend Mr. Forbes requested my assistance, the publication of any discovery on this subject which may from time to time have occurred to me; but as in his opinion the anticipation by this mode of publication of any such discoveries would increase, instead of diminishing, the interest of the proposed work, I will give a short account of some important additions to the Catalogue of British Shells, for which I am principally indebted to my indefatigable friend and collaborateur, George Barlee, Esq., during his excursion to the western coast of Scotland last year.

Pteropoda ?

Orbis foliaceus, Philippi, vol. ii. p. 147. tab. 24. f. 26. Several specimens of this singular shell occurred to us in about fifty fathoms water off Skye. I doubt this species being the same as that of Philippi, because in perfect specimens the last whorl exceeds in size all the others so as to form an obtuse keel. One specimen is remarkable for its having two apertures occasioned by a malformation of the first, and the animal having subsequently formed another to replace it. This monstrosity is occasionally found in the shells of Gasteropods.

Gasteropoda.

Bulla pruinosa, Zool. Journ. vol. iii. p. 341. One specimen of this shell, which had not been, as far as I am aware, rediscovered by any collector since the publication of the species by Mr. Clark in 1827 as an Exmouth shell, occurred from Loch Fyne. Mr. Barlee observed a specimen in the Rev. Dr. Fleming's collection, and procured another specimen last year from Branscomb, Mr. Clark's dredger at Exmouth.

Bulla acuminata, Phil. vol. i. p. 122. t. 7. f. 18. A single specimen (although broken) from Loch Fyne. Mr. Alder informed me that he had also found one specimen on the west coast of Scotland.

Bulla truncatula, Phil. vol. i. p. 122. t. 7. f. 21. *Volvaria subcylindrica*, Brown, p. 3. pl. 19. f. 19, 20. Several specimens of this very distinct shell occurred in from twenty to fifty fathoms from the coast of Skye.

Bulla mammillata, Phil. vol. i. p. 122. t. 7. f. 20. Skye. This species had previously been found by myself and others at Exmouth and on other parts of the south coast.

Rissoa Barleei. Shell subcylindric, smooth, solid, of a yellowish horn-colour. Volutions six, gradually increasing in size, and more or less decorticated at the top; suture slight. Apex obtuse. Aperture oval, contracted and surrounded by a complete peristome and having the outer lip inflected towards the pillar. Umbilicus none. Length $1\frac{1}{2}$ line; breadth $\frac{5}{4}$ of a line.

Loch Carron and Skye in twenty to fifty fathoms.

This species has very much the appearance of *Rissoa* (*Paludina*) *Ulvæ*, but differs from it in its subcylindrical form, its rather more solid texture, in not having the last volution angulated, and above all in its more contracted aperture and the peculiar inflexion of the outer lip. Its habitat is also very different. I had not an opportunity of examining the animal.

Rissoa clathrata, Phil. vol. ii. p. 223. t. 28. f. 20?. *Cyclostrema zetlandicum*, Flem. Brit. An. p. 312.

In fifty fathoms off Skye.

Rissoa abyssicola, Forbes. In the same locality as the last.

Eulima distorta (*Melania distorta*, Desh.), Phil. vol. i. p. 158. t. 9. f. 10. Oban and Loch Fyne.

This species was also found many years ago by Mr. Clark at Exmouth; and several other localities in Great Britain are now known for it.

Chemnitzia rufescens, Forbes. *Turritella indistincta*, Flem. Brit. An. p. 304. *Melania scalaris*, Phil. vol. i. p. 157. t. 9. f. 9? From the same locality as the last. I obtained it in 1843 and 1844 in various parts of the western coast of Scotland.

Eulimella (Forbes) *crassula*, Mal. and Conch, J. *E. MacAndrei*, Forbes in Ann. Nat. Hist. vol. xiv. p. 412. In many parts of the western coast of Scotland.

Eulimella gracilis. Shell elongated, of a rather thin texture, smooth, glossy, white. Volutions ten, gradually increasing in size and tapering to a point: they are rounded and well-defined by the line of separation. Aperture oval, angulated and slightly channelled at the base. Peristome not folded on the pillar. Umbilicus none. Length $\frac{4}{20}$ths of an inch; breadth $\frac{1}{20}$th.

Several specimens of this beautiful and very distinct shell were found by Mr. Barlee at Oban, and since in Loch Fyne.

Pleurotoma variegatum, Phil. vol. i. p. 19. t. 11. f. 14. A single specimen of a shell which appears to be the above species occurred to me at Loch Carron in 1843. It differs from *Pl. purpureum* in the texture of the shell being thinner, the volutions more rounded, and the longitudinal ribs more numerous.

Pleurotoma Boothii, Smith in Wern. Mem. Oban and Skye. This species is scarcely distinguishable from *Pl. lineare*. I observed specimens in Mr. Metcalfe's collection of shells from Herm, one of the Channel Islands, mixed with the other species.

Pleurotoma scabrum. Shell oblong, yellowish white. Volutions six or seven, tapering and rounded, having each marked with twelve rather oblique longitudinal ribs, which are crossed by about the same number of raised transverse striæ which produce tubercles at the point of junction, and are of a purplish brown colour. Suture rather deep and well-defined, showing the gradual formation and prolongation of the slit. Aperture oblong. Canal short. Umbilicus none. Length $\frac{8}{20}$ths of an inch; breadth $\frac{3}{20}$ths.

Two specimens of this shell were found by Mr. Barlee at Oban. It differs from *Pl. lineare* in the volutions being more tapering, and generally in its more slender form, and in the ribs and transverse striæ being sharper and more elevated, giving the shell a scabrous appearance.

Pleurotoma brachystomum, Phil. vol. ii. p. 169. t. 26. f. 10. Oban, Loch Carron and Skye, as well as in Bantry Bay. This

species seems to be represented in fig. 14 of the plate to Capt. Laskey's account of North British Testacea in the Memoirs of the Wernerian Society.

Pleurotoma Ginannianum, Phil. vol. ii. p. 168. t. 26. f. 6. *Ichnusa Setabu*, Clark, MSS. Lerwick (1841) as well as the southern and western coasts. This species is closely allied to the last. It differs from *Pl. nebula* in more abruptly tapering, having a rough aspect and the ribs being more raised and arched. The aperture is more straight and contracted. The colour is always of a uniform yellowish brown, but the *P. nebula* is yellowish white, with invariably two dark purplish bands on the last volution, one of which is continued on the upper part of each of the other volutions. This species seems also to be more common and generally distributed than the *Pl. nebula*, which is a southern form.

Several of the rarer species of *Pleurotoma* (including *Pl. teres, coarctatum, Trevelyanum, accinctum*, &c.) also occurred to us.

Buccinum Humphreysianum, Zool. Journ. vol. i. p. 398. A young specimen of this shell was found by Mr. Barlee at Skye.

Emarginula crassa. Skye, Lochs Duish and Fyne.

Cemoria Noachina. Not uncommon on many parts of the western coast of Scotland.

Velutina flexilis. Skye, and by myself in 1844 at Ullapool.

Patella fulva. Not uncommon on many parts of the western coast of Scotland.

Chiton Hanleyi. Oban and Skye.

Chiton cancellatus. *Ch. alveolus* (Sars), Lovén, Moll. Scand. p. 27 ?.

Chiton albus. On several parts of the western coast of Scotland.

One specimen of *Chiton*, which appears to be undescribed, was found by Mr. Barlee at Inverary; but until more specimens have been found, it is perhaps better not to assign it a distinct name at present. It resembles in form *C. albus*, but is more strongly beaked and the granulations are more like those in *C. marginatus*. The margin is intermediate between the two. Colour brownish white.

Acephala.

Terebratula seminulum, Phil. vol. i. p. 97. t. 6. f. 15 *f*? One specimen was found by me in company with Mr. Barlee at Skye in fifty fathoms attached by its byssus.

The species is described by Philippi to be very variable in form; but I am not quite satisfied as to the identity of my shell with that species. This is half the size, of a brownish colour, and nearly smooth, whereas the *T. seminulum* is of a whitish colour, and thickly punctured over the surface. Further discoveries may clear up the doubt.

A depressed variety (?) of the *Ostrea edulis*, having the inside

of a dark purplish colour, and nearly answering Philippi's description and figure of *Ostrea depressa* (vol. i. p. 89. t. 6. f. 3), is occasionally found on the western coast of Scotland.

Pecten striatus, Müll. Not uncommon on many parts of the western coast of Scotland as well as of Ireland.

Pecten adspersus, Lam. *Pecten danicus*, Mart. and Chemn. *Pecten glaber*, Pennant, Br. Zool. vol. iv. p. 223; Mont. Supp. p. 59. t. 28. f. 6? Abundant in Loch Fyne, and sparingly on other parts of the western coast of Scotland. A white variety also occurs, although rarely; and another variety having strong longitudinal striæ between the ribs towards the margin.

Pecten Dumasii, Payr. p. 43. pl. 2. f. 6 and 7. Skye. I cannot agree with Philippi that this is a variety of the last. It is distinguished by being narrower, having the ribs more elevated, and close-set longitudinal prickly striæ between the ribs.

Pecten Pes-felis, Lam. Loch Long, but only single valves occurred to Mr. Barlee.

Pecten lævis. On many parts of the western coast of Scotland.

Modiola phaseolina, Phil. vol. i. p. 51. t. 15. f. 14. On many parts of the western coast of Scotland, where it first occurred to me in 1843.

The *Mod. costulata* (Risso), Phil. vol. i. p. 50. t. 15. f. 10, has occurred to me on the southern and western coasts of England.

Nucula Polii, Phil. vol. i. p. 63. t. 5. f. 10. Oban. This species has also been found in Dublin Bay, and I believe in other parts of Scotland and Ireland.

Leda (Schumacher) *tenuis*. *Nucula tenuis*, Phil. vol. i. p. 65. t. 5. f. 9. *Leda pygmæa*, Forbes in Mem. of Geol. Surv. p. 419. Not uncommon on the coast of Skye.

Arca pectunculoides (Scacchi), Phil. vol. ii. p. 44. t. 15. f. 8. With the last.

Cardium suecicum (*Loveni al.*). Oban, and on many other parts of the western coast of Scotland.

Cardium nodosum. Lerwick in 1841, and with the last.

Tellina balaustina, Poli. Skye. This is the second occurrence of this beautiful species in this country.

Lucina spinifera. On many parts of the western coast of Scotland.

Poronia (?) *ferruginosa*.

Artemis (?) *ferruginosa*, Forbes. In 50 to 100 fathoms, Skye and Loch Fyne: some specimens from the latter place are double the usual size.

Venus Plagia. Shell oblong, compressed, brownish white, glossy, marked transversely with antiquated ridges, which are stronger towards the margin and anterior extremity, and crossed

longitudinally by oblique striæ which diverge from the hinge to the margin. There is a strongly developed flexuosity at the anterior extremity which terminates in rather an acute edge. Hinge as in *V. Pullastra*. Breadth $1\frac{5}{8}$ inch; length 1 inch.

A single valve of this size occurred to me at Lerwick; a small live specimen at Deal Voe in the Shetlands; and a still smaller specimen was found by Mr. Barlee in Loch Fyne.

It has a considerable resemblance to *V. Pullastra*, but it differs in the peculiar obliquity of its form as well as its greater breadth and other particulars.

Astarte crebricostata, Forbes in Ann. Nat. Hist. vol. xix. p. 98. Skye, but only single valves were found.

Many specimens of *Astarte* were extremely difficult, if possible, to be distinguished specifically, and the variety of form in this genus is very puzzling. I am quite satisfied that the crenulation of the margin is not a specifically distinctive character; nor the number of ribs, nor the form, much less the size or colour. With respect to size, I may observe that specimens of *A. compressa* measured more than three-quarters of an inch in diameter.

Psammobia (?) *plicata*. *Mytilus plicatus*, Mont. Suppl. p. 70; Laskey in Wern. Mem. pl. 8. f. 2. Two single valves of this curious shell were found by us in fifty fathoms off Skye. Mr. Hanley had previously taken it at Ryde.

It has much the aspect of a *Panopæa*.

Psammobia costulata.

Psammobia strigillata. Skye.

Corbula (?) *granulata*, Nyst, Belg. Foss. p. 71. pl. 2. f. 6. *Tellina polygona*, Mont.? I dredged one (live) specimen of this curious shell in fifty fathoms off Skye.

Neæra abbreviata, Forbes. Between seventy and eighty specimens of this shell were procured by Mr. Barlee in Loch Fyne.

Many other extremely rare and interesting shells occurred, but I have already I fear trespassed too long on the columns of this month's 'Annals.'

XXXIV.—*Notes on the genus of Insects* Omias, *with descriptions of new species*. By John Walton, F.L.S.

Fam. CURCULIONIDÆ.

Genus Omias, *Germ. olim, Schönh., Latr., Dej., Sturm.*
Thylacites (*Brachysomus*), Schönh. olim.
Otiorhynchus, Brachysomus, Steph.

Char. Gen. "Antennæ moderate, either slight or rather stout; scape generally longer than the head, more or less curved, towards the apex incrassated; first and second joints of the funi-

culus short, obconic, the first being somewhat longer and thicker than the second, 3—7 nodose; club ovate. Rostrum short, narrower than the head, having generally a somewhat triangular impression above towards the apex, in some a little flat; the scrobes short, subcurvate. Eyes rounded, convex, small. Thorax either short or oblong, truncated at the base and apex, slightly rounded at the sides, a little narrowest in front. Scutellum in most specimens none, in a few triangular, minute. Elytra ample, either short-ovate or oblong-ovate, very convex above."

"*Observ.* Body either subrotundate or subovate, apterous; of very small size." Transcribed from Schönherr.

1. *Omias hirsutulus*, Fab., Marsh., Gyll., Germ., Schönh.
Brachysomus hirsutulus, Steph.

Not very abundant: found in whitethorn hedges on a gravelly or chalky soil at Gravesend, Shirley Common, and Mickleham, in May and June.

2. *O. Bohemani*, Schönh.

Ovate, nigro-piceous, shining, and densely clothed with erect cinereous hairs. Head small, narrow, black, sparingly pubescent, the vertex smooth, the front closely and minutely punctured; eyes small, round, moderately prominent and black; rostrum narrower than the head and scarcely longer, stout, plane above, black, closely and finely punctured, and distinctly canaliculated. Antennæ inserted near the apex of the rostrum, and reaching beyond the base of the thorax, rather slender, pale testaceous, and sparingly pubescent, the clava long-ovate, acuminated. Thorax broader in the middle than long, more narrowed anteriorly than posteriorly, moderately rounded at the sides, very convex above, piceous-black, shining, densely pubescent, closely and very minutely punctured. Scutellum indistinct. Elytra ample, globose-ovate, very convex above, piceous, deeply punctate-striate, the interstices moderately convex, smooth, and thickly clothed with erect cinereous hairs. Legs moderate, pale testaceous and pubescent. Length $1\frac{2}{3}$ line.

Of this very distinct insect, which is new to the British fauna, I possess foreign examples from Schönherr.

Mr. T. V. Wollaston captured a specimen by brushing amongst grass in a meadow near Stamford, and liberally presented it to me: received from York, Newcastle and Chesterfield by Mr. S. Stevens, who kindly supplied my cabinet with specimens.

3. *O. brunnipes*, Oliv., Steph. Manual.
Curc. piceus, Marsh., Kirb. MSS.
Otior. piceus, Germ., Steph. Illust.

This insect, with its numerous varieties of form, size and co-

lour, may be distinguished as being nearly glabrous and very shining; as having the thorax subglobose, coarsely and remotely punctured; the scutellum distinct, triangular, and the elytra globose-ovate.

I possess authentic specimens of *O. mollicomus* of Ahr. from Germar, and of *O. pellucidus* from Chevrolat, which are distinct species; and although closely allied to *O. brunnipes*, they may readily be distinguished from that insect by having the elytra oblong-ovate, and being clothed with hairs. Mr. Stephens, in his 'Manual of British Coleoptera,' has introduced the above-named two species as indigenous, but I have not hitherto observed a specimen of either in any collection.

Common in hedges in sandy districts in June and July.

4. *Omias sulcifrons*, Schönh.

Oblong, black, shining, and very sparingly clothed with short, scattered, white pubescence. Head large, very broad, the vertex convex, closely punctulated, the front deeply furrowed to the apex of the rostrum; eyes small, rotundate, very prominent; rostrum scarcely as long as the head, and but a little narrower, and thickly punctured. Antennæ rather slender, rufo-ferruginous, the clava long-ovate and very acute. Thorax a little broader in the middle than long, narrowed anteriorly, moderately dilated and rounded at the sides, rather convex above, coarsely punctured towards the sides, and remotely and irregularly on the disk. Scutellum small, triangular and distinct. Elytra oblong-ovate, nearly glabrous, rather wider at the base than the thorax, the shoulders rounded and not elevated, somewhat dilated at the sides, moderately convex above, punctate-striate, the interstices plane and rather smooth. Legs rufo-ferruginous, shining and pubescent. Length $1\frac{1}{2}$—$1\frac{2}{3}$ line.

Readily recognised by its broad head and deep sulci, and by its elongate form.

This insect, which is new to this country, was unknown to Schönherr until I sent a specimen.

First discovered in Dalmeny Park, Scotland, by Mr. R. N. Greville in August; and subsequently found at Mount Edgecomb, Devonshire, in May, by Mr. T. V. Wollaston; to both of these gentlemen I am indebted for specimens.

It is necessary to notice that the insect included in the genus *Cathormiocerus* (*Trachyphlœus olim*) of Schönherr, and described under the name of *C. socius*, with the addition of "Patria Anglia. Mus. Dom. Walton," I gave to Schönherr; it is the only specimen I have seen, and I think it came into my possession with the collection of the late Mr. Millard of Bristol. Of its history and locality I am equally ignorant: the genus only contains two spe-

cies, and *C. horrens,* an exotic insect, is the type; under these circumstances I consider that it is sufficient to refer to the elaborate generic and specific characters given by Schönherr rather than to transcribe them*.

XXXV.—*On the Development of the* Lycopodiaceæ. By Karl Müller†.

[With five Plates.]

[Concluded from p. 249.]

c. The morphological import of the spore. Up to the present time it remains doubtful what purpose is served by the antheridium-spore. One person maintains this opinion, another that. This author declares that he has seen it germinate, the other that he has never been able so to do. Kaulfuss (Das Wesen der Farrenkräuter, &c. Leipz. 1827) relates (p. 23) that, first, Fox sowed *Lycopodium Selago,* then Lindsay *Lycop. cernuum* with success, and that *Lycopodium clavatum* had sprung up in abundance with Willdenow. With himself it did not succeed, yet the garden-inspector Otto, at Berlin, raised *Lycop. pygmæum,* Kaulf., from seed, for several years in succession. The last case however is easily explicable, since the *Lyc. pygmæum* which I know by this name from the hands of the exact Kunze, possesses oophoridia also; and that these germinate is known. Here therefore we cannot place full dependence even on the assurance of such an authority as Willdenow.

An observation of Göppert's‡ however is of far greater importance from the fact, that it does not merely amount to a confirmation; this was beholding young plants produced from the antheridium-spores of the same *Lyc. denticulatum,* the development of which we have above become acquainted with. His observations were first published in the 'Uebersicht der Arbeiten und Veränderungen der schlesischen Gesellschaft für vaterländische Kultur,' in the years 1841 and 1845. In the latter the author has also, although imperfectly, furnished illustrations to it. The observations were next published in No. 7 of the literary notices in the 'Flora,' p. 110, and lastly by Röper (in the 'Flora Mecklenburg's,' i. p. 126). The passage in question is here transcribed *verbatim* for those who may not have access to any of these books:—

* Syn. Ins. vii. p. 120, 121.

† From the 'Botanische Zeitung,' Oct. 2, 1846. Translated by Arthur Henfrey, F.L.S. &c.

‡ I have only become acquainted with it since the second section was printed.

"Both kinds of spores (in *Lyc. denticulatum*) have already been seen to germinate by Brotero and Salisbury (Trans. of the Linn. Soc. vol. xii. p. 2. tab. 19). The accuracy of these observations was however questioned by G. W. Bischoff (Krypt. Gew. 2 Lief. p. 111), because Salisbury's figures exhibited, throughout, too great an agreement with the germination of a dicotyledonous plant*. In November 1840 I noticed in a flower-pot standing near *Lyc. denticulatum* in the hothouse of our botanical garden, some germinating plants which on closer inspection and their further development I was enabled to recognise as *Lyc. denticulatum*. They exhibited two conditions: *one kind which had been developed from the delicate pulverulent seeds were one-eighth of a line high, and were already thickly clothed from the rootlets upward with alternate leaves, but they did not divide in the bifurcate manner so peculiar to the* Lycopodia *until they had attained a length of from three to four lines*. The others differed strikingly from these, outwardly, and at the first glance appeared to possess the greatest similarity with a germinating dicotyledonous plant. The outermost envelope of the spore was still adhering to the spot from which the roots, three to four lines long, extended downward, so that no doubt could remain as to the development from it, and from the same envelope was prolonged a perfectly naked stem two to three lines long, projecting above the surface of the ground; the upper part bore the first leaflets, which however did not stand opposite one another like the seed-leaves of the Dicotyledons, but alternate: this however could only be ascertained by a pretty close examination; and therein lies the mistake of the illustrations figs. 2, 4 and 5 of Salisbury, who has represented the leaves as opposite†. Above these leaflets the axis divided into two branches of equal development, so that the dichotomy appeared at once here, while in the former it did not occur until after the development of eight to ten whorls of leaves. Moreover in these the leaflets were also twice or thrice as large as in the others."

I have also related this author's observations on the germination of the oophoridium-spores here, because I hold them to be an evidence, that Göppert saw real germinating plants of *Lyc. denticulatum*, and to him the Lycopodial nature of the plants produced from the antheridium-spores must be indubitable. Assuming this, implicit trust may be placed on so accurate an observer as Göppert; yet I cannot suppress some perverse doubt, which his figures have inspired me with. In the first place, they are figured under too small a magnifying power to show more than

* As is well known, Bischoff retracted this in an appendix to his 'Krypt. Gew.,' having himself observed this germination.

† According to my observations Salisbury is quite right.

the branches and leaves. Then, figure 17 appears to me so like a young plant of *Fissidens*, a moss which often enough occurs in flower-pots in our green-houses, that I am involuntarily—I hope M. Göppert will, in such an important circumstance, be charitable enough to pardon me—led to imagine that he may have been deceived. By one single argument however Göppert could free himself at once from this suspicion—if, namely, he can assure us positively that he has seen the antheridium-spore still adherent to the young germinating plant; a condition of which he has made no mention. If this was actually the case, an axis must have been developed at once from the spore, and thus a confusion with a young moss plant would have been impossible, because in this as in many other Cryptogamous families a protothallus is developed first, and then a bud is afterwards produced upon this, from which the axis and the remainder of the plant are developed. Moreover the Lycopodial nature might have been pointed out at once, from the structure of the leaf. But Göppert's figures give nothing of this, and, alas! the subsequent development of the plant is wanting altogether.

Although I do not now throw any doubt *on the possibility* of the germination of the antheridium-spores, yet one involuntarily asks, how then are the *Lycopodia* without oophoridium-spores propagated? we must still wait for further observations which shall offer a complete history of the development. But it always presents itself to me as a peculiar phænomenon, that some observers have unanimously described plants produced from antheridium-spores, while others again have altogether failed in discovering them. This has been my own case, although I have kept *Lyc. denticulatum* more than half a year in a room, and observed dozens of germinating plants developed from oophoridium-spores and have sown numbers of antheridium-spores. Just the same has occurred to me with the spores of *Psilotum triquetrum*, although, according to Kaulfuss (*l. c.* pp. 10 and 27), the inspector Otto found *Bernhardia dichotoma* quite separate from the parent plants upon roots of plants, in many pots in the Berlin gardens, a phænomenon which Dr. Fischer has also observed upon a palm root in Gorenki. Enough of all these opinions and assurances; they are altogether too doubtful to allow any conclusions to be drawn from them. One can only urgently desire that this important point may right soon be settled.

§ 6. *Retrospect.*

The following are the points which may be considered as surely proved in the foregoing history of development:—

1. The *Lycopodiaceæ* possess two kinds of organs of fructifica-

tion, antheridia and oophoridia. The spores of the latter certainly germinate; of the former, it is still doubtful.

The *antheridium-spores* correspond to those of such cryptogamia as are formed to the number of four in a mother-cell.

The *oophoridium-spores* correspond to the ovule of the higher plants; nearest to those of the *Rhizocarpeæ* if the ovule is understood as a mother-cell produced by the axis, inside which the plant is formed. It appears to me that nothing can be objected to this: the inner membrane then would correspond to the embryo-sac of the ovule of *Rhizocarpeæ*, and the outer in like manner would be the analogue of the external membrane of the same ovule. Since in these, according to Mettenius (Beitr. z. Kentniss der Rhizocarpeen), the embryo-sac originates by the deposition of membranous substance, or rather by the secretion of the internal membrane, so also must it be formed in the *Lycopodium* ovule in the same manner, since it is produced at a later period.

If this comparison, of the oophoridium-spore with an ovule, have a good foundation—and I see with pleasure that Spring is of the same opinion, which so much the more strengthens me in my views that I did not yet venture to assert them in the second section, and only determined to regard them as clear and correct after subsequent explanations—the *Lycopodium* ovule thus becomes of as much consequence in a systematic point of view as that of *Rhizocarpeæ* has become since an impregnation has been distinctly pointed out in it. Perhaps I may be allowed to express briefly and conclusively what here presses itself upon us involuntarily as *a necessary consequence*, in propounding here five chief stages in the formation of plants. Four of them have perhaps already been propounded by many authors; but hitherto they have never been displayed in connection with one another.

The vegetable kingdom commences with a single cell. It becomes a mother-cell, new cells being formed in its interior. The daughter-cells propagate the species in a similar manner, these again also becoming mother-cells. This is the case in the *Bacillariæ* and plants of the genus *Protococcus*. Schleiden will pardon me if I reckon the *Bacillariæ* and *Desmidiaceæ* decidedly among plants. In *Frustulium* I believe that I have distinctly observed a single cell expand itself into the so-called *siliceous lorica*, inside which new chlorophylle-like cells were formed, from which the species was again propagated in the same manner. This I have clearly observed in my *Frustulia polymorpha* from the North Sea—no matter where this be arranged, since my honoured friend Kützing has passed it over in silence in his work on the *Bacillariæ*. I believe that I saw it also in an *Achnanthes*, which appeared to me to be *Ach. panduræformis*. Moreover I have observed in *Closterium Acus* cell-formation in the interior *from cytoblasts*, which wholly

corresponded with that observed by Schleiden himself. In my estimation however, that is a vegetable cell which possesses *no contractility* (like that of the animal), whereby we can at the first glance through the microscope distinguish a simple animal cell, like that of a *Monas*. The development of chlorophylle in the interior of this vegetable cell is to me the second important distinction. A third lies in the colour of the animal cell, which can only be comprehended by actual sight, which cannot be expressed, and varies from the hyaline appearance of the vegetable cell to the reddish colour of cytoblastema.

Next to this structure follows, secondly, the simple spore, from the Algæ to the Ferns. *Here the plant is formed outside the spore,* which elongates in a tubular manner: there are several modifications of this. In the Algæ—*e. g.* in *Chara,* which I include here on account of the agreement of its fruit with that of *Chætophora,* in *Chætophora tuberculosa* and *endiviæfolia,* where I have distinctly observed it—the whole spore grows out at once into an axis, which is in fact nothing more than a simple tube. Whether the so-called *Florideæ* among the Algæ, ally the true seaweeds, to the following modifications, I know not. In these, as is well known, a proto-thallus is developed and the plant is then produced from a bud which is formed upon it. This occurs from the Fungi—in the Lichens it is only probable—to the Ferns. It is sufficiently known that further modifications occur in the protothallus, that this sometimes appears as a tubular filament, sometimes as a tissue of filaments, according to the more highly developed structure of the family. A higher step is at all events taken by nature if Göppert's observations shall be confirmed—that an axis is developed at once from the antheridium-spore of *Lycopodium*.

To this widely distributed structure succeeds, *thirdly,* the *ovulum* of the *Selaginellæ*. *Here the plant is produced without impregnation in the interior of the ovule, consequently in an embryo-sac, and perfected externally.*

Fourthly, we come to the *ovule of* Rhizocarpeæ: *here the plant is produced in the interior of the ovule by impregnation in the manner pointed out by* Schleiden, *the embryo being formed in the pollen-tube outside the embryo-sac, and the plant perfected on the outside of the ovule; but the acts of impregnation and germination are simultaneous stages.* In the *Rhizocarpeæ* the axis originates free in the germinal "nidus" (*Wulste*) serving as envelope (the germ, *Keimkörper*), which may be compared to the proto-thallus of the preceding Cryptogamia, only that here it is formed in the interior of the ovule. In the ovule of *Lycopodium* the axis still grows in connection with the germinal body. Up to this point no main root occurs, since, according to Mettenius, the root of the *Rhizocarpeæ* is not a main root, as Schleiden considered it.

Lastly, we see in the *fifth* place, *that the acts of impregnation and germination have become two independent stages; then the embryo is produced by impregnation inside the ovule, in fact in the embryo-sac, and is at once so fully perfected, that the act of germination is nothing more than an evolution of an already fully-formed part. Here therefore the plant is produced and perfected in the interior of the ovule.*

The degree of importance the *Lycopodiaceæ* possess in this series is at once evident. They unite the sexual plants with the asexual (*Agamæ*), the plant being actually formed in the interior of the ovule without the occurrence of impregnation. They possess therefore the ovule of the sexual plants and the gemmation of the asexual, and thus make good their place for ever *between Ferns and Rhizocarpeæ.*

2. *In the formation of the plant in the interior of the ovule all cells originate singly.* This is not in opposition to the law laid down by Schleiden, that the cells are developed within cells. Here the ovule is to be regarded as the common mother-cell for many cells. As we here see therefore distinctly that the cells are formed without impregnation, I must mention a phænomenon which Spring relates in his "Monographie de la Famille des Lycopodiacées" in the 'Mémoires de l'Académie Royale de Bruxelles,' tom. xv. He says that R. Brown has often seen the escape of a fovilla-like mass from the spores of *Psilotum triquetrum*, and that he also has often noticed it. This may easily be, since we have above become acquainted with a finely granular matter contained in these spores. I have never seen any fovilla-like mass escape, but certainly the above-described granular contents, which often become elongated and branched. This phænomenon however Spring holds to be very important, without giving any further explanation of it. But if in this importance an intimation is given of anything analogous to an act of impregnation, it disappears of itself before the direct proof that the ovules never open to absorb a fovilla.

Every cell is self-formed, the protoplasma of the ovule being precipitated round a central nucleus, and the outer layer becoming hardened. As in the *Rhizocarpeæ*, where Mettenius (*loc. cit.*) traced the course of formation of the cell, the cells here appear at first as cavities in the protoplasma, since the substance around the nucleus is so transparent that it cannot be detected. An outer ring of protoplasma alone, more granular than the rest, is to be seen, and the outermost layer of this becomes membrane. I have never perceived a cytoblast here in *Lyc. denticulatum*; this structure therefore must be regarded as a modification of cell-formation.

3. *The terminal bud alone is formed by the plant inside the ovule.*

The rootlets are not formed till afterwards upon the outside of it. Another proof that the *Lycopodia* cannot be said to have a main-root.

4. *The terminal bud becomes inclosed by an envelope* (*two bud-envelopes, Knospenhüllblättern*). These remind us of the cotyledons of the Dicotyledons. At all events those bud-envelopes are identical with it, which so often occur in the Phanerogamia, *e. g.* in many *Leguminosæ,* as in *Amicia, Lathyrus, Pisum,* in *Agrimonia,* in *Cunonia capensis,* especially, exactly as in *Selaginella denticulata,* in the Begonias, &c. Here these enveloping leaves have usually been looked upon as stipules. It is impossible that they can be such; for they are distinguished from true stipules, *e. g.* in Roses by the fact that they always inclose axial buds, and always surrounding the stem at the origin of the internode, they persist or drop off (*Cunonia*), while the stipules, mere appendicular organs, rest upon the leaves. This is alluded to in another place.

5. *The* Selaginellæ *possess a main-axis.* This however remains very short and divides at once in the terminal bud into two branches, which in like manner always divide again dichotomously. Hence the "caulis dichotomo-procumbens."

6. *The leaf is merely an "outshoot" (Auftreibung) of the stem, which expands into a flattened body.*

7. *In* Selaginella denticulata *an accessory organ also is found between the axis and the leaf; the import of this is as yet doubtful.* In more recent researches in living *Selaginellæ* I found it also in *Selaginella stellata, apus* and *viticulosa,* and of exactly the same structure. It thus becomes probable that it extends throughout the whole of the genus *Selaginella.*

8. Among the significant peculiarities in *Selaginella* is also to be included the extremely regular position of the branch-roots. I mentioned above that they are formed upon the upper side of the stem in *Selag. denticulata,* and that Schleiden, without referring to the species, says that he has observed them on the under side. Since this was printed I have become acquainted with several living *Selaginellæ* in the Berlin Botanic Garden, and I found in one of them, in *Selag. stellata,* Spr., a confirmation of Schleiden's assertion. I thus had an opportunity to seek for the law which prevails here. It proves to be as follows: the roots of the branches make their appearance both on the upper and under side of the stem, but always just inferior to the forked division of a branch, and indeed within its last leaf. If this be on the upper side—and then it is a folium intermedium—there, also, the branch-root appears. But if the leaf be on the under side—and it is then a larger leaf—the branch-root also is formed on the under side always between the stem and leaf, consequently as a true branch.

9. *The oophoridium in* Selaginella denticulata, *and all those* Selaginellæ *where it stands at the base of the spike, is always a metamorphosed main-branch.* This is the case in *Selag. ferruminata,* Sprg. (= *elongata,* Klotzsch), *lucidinervia,* Sprg. (= *pedata,* Kl.), *conduplicata,* ej., *distorta,* ej., *Poppigiana,* ej., *sulcata,* ej., *stolonifera,* ej., *deliquescens,* ej., *puberula,* Kl., *lævigata,* Sprg., *articulata,* &c. Whether this law may be modified in those species where antheridia and oophoridia occur on one spike, whether it is here a transformed *secondary* branch, *e. g.* in *S. stellata,* Sprg., *pygmæa,* ej., *helvetica,* ej., &c., yet remains to be investigated. In other *Selaginellæ,* the fruit of which is diœcious, where therefore oophoridia and antheridia occur on distinct spikes, the oophoridium appears to be a metamorphosed main-branch, *e. g.* in *S. selaginoides*—certain it is however that the oophoridium is never a leaf-product.

The oophoridium-spores, more properly the ovules, are formed at the extremity of the vascular bundle which projects free into the interior of the oophoridium as a hollow mother-cell. The course of its development still requires to be more minutely investigated.

10. *The antheridium* is a metamorphosed twig-bud* (*Zweigknospe*) *developed simultaneously with the leaves from the axis,* a twig here being understood to be a secondary branch. The antheridium is never a leaf-product. Here refer also the sporangium of *Psilotum* and *Tmesipteris.*

The antheridium-spores originate by fours in a mother-cell, and certainly by cytoblast-formation as understood by Schleiden (formation of a membrane around a nucleus), never by division of the cytoblastema.

EXPLANATION OF PLATES II. to VI.

Plate II.

Fig. 1. The germinating spore: *a*, the rootlet; *b*, the terminal bud; *c*, the germ. 250†.

Fig. 2. The terminal bud so seen that the other branch-bud lies behind the one *a*. 250.

Fig. 3. The same, unfolded artificially. 250.

Fig. 4. The whole germinating plant, removed from the spore: *a*, the point of vegetation for the stem and root; *b*, the germ (*Keim-körper*). 50.

Fig. 5. The germinating plant with the bud-leaves. 10.

Fig. 6. A bud-enveloping leaf, with a branch-bud *a*; *b*, an accessory organ. 250.

Fig. 7. The base of the bud-envelope. 400.

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* The word *Zweigknospe,* literally twig-bud, is here used in distinction to *Astknospe* or branch-bud, which latter may be regarded as determining the bifurcation of the main axis, while the former is a secondary ramification.—Tr.

† The figures give the magnifying power.

Fig. 8. The branch-bud from fig. 6 *a*, unfolded; *a*, pre-formed leaf. 250.
Fig. 9. The same unfolded, with the terminal bud of the young branch *a*. 250.
Fig. 10. The last magnified 400 times.
Figs. 11—19. Germinating plants, more or less developed, magnified 5 to 10 times.

PLATE III.

Fig. 1. Accessory organ of the leaf. 250.
Fig. 2. The same cut across between the leaf and branch parenchyma. 400.
Fig. 2*a*. The same cut across between a leaf and branch. 50.
Fig. 3. The same, magnified, at the apex, 400 times.
Fig. 4. The same, bifurcate. 250.
Fig. 5. The same cut lengthways. 400.
Fig. 6. The same in its earliest development on a young leaf from the terminal bud of germinating plant, seen laterally. 400.
Fig. 7. The same, seen crossways. 400.
Fig. 8 and 8*a*. The same in course of development on the youngest branch of the perfect plant. 250.
Figs. 9 and 10. The same, isolated and more developed. 250.
Fig. 11. Longitudinal section of the axis-branch, to show the various anatomical relations: *a*, accessory organ with its basilar cells; *b*, cortical layer of the branch; *c*, inner leaf-cells; *d*, the elongated base of the leaf. 250.
Fig. 11*x*. Longitudinal section of the leaf. 50.
Fig. 12. Cross section of the axis-branch. 250.
Fig. 13. Longitudinal section of the apex of the branch. 50.

PLATE IV.

Fig. 1. Cross section of a branch at a node with the branch-root forming. 50.
Fig. 2. The same. 50.
Fig. 3. The ophoridium, *in situ*. 50.
Fig. 4. The same, seen from beneath. 50.
Fig. 5. The same, seen from above. 50.
Fig. 6. Two branches producing, *a*, an oophoridium, and *b*, a spike with antheridia. 250.
Fig. 7. An oophoridium in longitudinal section, in a very young condition: *a*, the epidermis of the oophoridium; *b*, the same, produced downward at the base; *c*, mother-cell of the spores; *d*, contents of the future fruit-stalk. 250.
Fig. 8. The same, seen from behind. 250.
Fig. 9. A similar one with a more highly magnified mother-cell *a*; *b*, cells on the base of the interior of the oophoridium. 400.
Fig. 10. An oophoridium, very young, *in situ*, seen from above. 10.
Fig. 11. The same, the longer side. 10.
Fig. 12. The same, the shorter side. 10.
Fig. 13. The spikelet with the oophoridium. 10.
Fig. 14. Oophoridium *a*, and antheridia *b*, *in situ* on a fruit-axis cut longitudinally. Only the central portion, represented with the cortical layers of the axis removed. 50.
Fig. 15. Mother-cells from the oophoridium of *Lyc. selaginoides*, with four young spores. 250.
Fig. 16. The last magnified 400 times.

PLATE V.

Fig. 1. Spores from the antheridium.
Figs. 2—6. The terminal bud of the antheridia-spike, with the antheridia forming upon it. 400.
Fig. 7. An antheridium, more perfect. 400.

Fig. 8. Another still further developed. 56.
Fig. 9*. Perfect antheridium *a*; accessory organ *b*; base of the leaf *c*. 50.
Figs. 9 and 10. Longitudinal sections of the sporangium of *Psilotum*. 50.
Fig. 11. Longitudinal section of an antheridium of *Lycopodium denticulatum*. 400.
Fig. 12. Cross section from the sporangium of *Psilotum*. 400.
Figs. 13—17. Forms of the development of the spores of *Psilotum triquetrum*. 400.

PLATE VI.

Figs. 1—28. Forms of the development of the spores of *Psilotum triquetrum*. 400.

XXXVI.—*On the Discovery of Silurian Rocks in Cornwall. By* Sir Roderick Impey Murchison, *G.C. St. S., F.R.S., V.P.G.S. & R. Geogr. S., Honorary Member of the Royal Geological Society of Cornwall, Mem. Imp. Acad. Sc. St. Petersburg, Corr. Roy. Inst. France, &c. In a Letter addressed to* Sir C. Lemon, *Bart., M.P., President of the Royal Geological Society of Cornwall.*

My dear Sir Charles,

In compliance with the promise I made when attending your last anniversary meeting at Penzance, I now give you a more decided opinion than I was then enabled to do, respecting the age of the lowest and oldest of the sedimentary rocks of Cornwall.

Not having seen the fossils collected by Mr. Peach on the south coast of Cornwall, I then found it difficult to come to any other conclusion than that at which Professor Sedgwick and myself had long ago arrived; viz. that with the exception of the presence, in the north-eastern extremity of the county, of a portion of the culmiferous (carboniferous) trough of central Devon, the remaining and underlying strata of Cornwall were of the age of the Devonian or Old Red system. The few Cornish fossils which were then shown to me in your museum, were unquestionably similar to those with which I was formerly familiar in Devonshire and North Cornwall, as well as with those of the Rhenish provinces and the Eifel, which Professor Sedgwick and myself had shown to occupy a like geological position. They were, in fact, forms of the same type as those which, at the suggestion of Mr. Lonsdale and with the assistance of Mr. James Sowerby on one occasion †, and with the help of MM. de Verneuil and d'Archiac on another ‡, we had published as characteristic of a group of intermediate characters, pertaining to strata lying *beneath* the carboniferous rocks and *above* the Silurian system. In a word, they were identical with some of the numerous fossils of Devon and North Cornwall, published in the work of Professor

† Trans. Geol. Soc. n. s. vol. v. p. 633. ‡ Ibid. vol. vi. pp. 221, 303.

Phillips*; who, in pointing out in certain tracts the connexion of this group with the carboniferous fossils, which he had so well described, and in others with the Silurian forms I had published, had also concluded that the great mass of fossiliferous strata which rise up from beneath the culm measures of central Devon were of the same intermediate characters. In his valuable Maps of Cornwall and Devon, Sir H. De la Beche gave essentially the same views of geological succession; and lastly, in his Report upon the geological structure of that region, he described certain detailed sections in the southern districts of Cornwall, to which I will presently advert.

In proposing the word "Devonian," as applied to the intermediate strata in question, Professor Sedgwick and myself fortunately thus qualified our meaning in regard to the extension of such rocks into Cornwall:—"In asserting that the stratified rocks of Devonshire and Cornwall are, upon a broad scale, the equivalents of the Carboniferous and Old Red systems, we do not however deny, that in certain tracts *the lowest members of some of these rocks may represent the upper division of the Silurian system*; for although we have as yet found few if any of the fossils most typical of that system, we admit that when the sediments of a given epoch have been accumulated under peculiar conditions, we must expect to find considerable variations in the forms of animal life. Again, we know that the rocks of this region have undergone great changes in assuming their hard and slaty character; and under such circumstances, the difficulty of precisely limiting the boundary line of any portion of them is prodigiously increased†."

The truth is, that neither Sir H. De la Beche and Professor Phillips, nor Professor Sedgwick and myself, had, at the time when our works were published, seen any fossils from *South* Cornwall sufficiently distinct to warrant the conclusion, that it contained forms of an older type than those which had been detected in North and South Devon and in the west of Cornwall. It was therefore believed (and all geological maps were coloured accordingly) that the zone of rocks occupying the southern headlands of Cornwall, between the Bay of Plymouth on the east and the Lizard Head on the west, were simply downward expansions of the fossiliferous "Devonian" strata. In this state of the question, your associate Mr. Peach began his labours in collecting fossils along the southern headlands of Cornwall. He first ascertained that certain forms first discovered by Messrs. Couch in the environs of Polperro were fishes, which he exhibited at the Cork Meeting of the British Association, and concerning

* Palæozoic Fossils of Devon and Cornwall.

† Phil. Mag. 1839, vol. xiv. p. 241.

which Professor Phillips and myself could only venture (so obscure did they appear to us) to give the guarded, though suggestive opinion, which Mr. Peach has recorded in your thirtieth Report. I then ventured to surmise, that these ichthyolites might belong to the Upper Silurian rocks, the oldest in which the remains of any vertebrated animals had yet been discovered, because "they occurred in rocks forming the axis of South Devon and Cornwall, which I had always considered to be the oldest in that country."

In pursuing his researches, Mr. Peach published in 1844 a synopsis of the Cornish fossils from various localities, in which, besides the ichthyolites of Polperro, he identified several mollusca from Gorran Haven, Caerhayes, and Carn Gorran Bay, with typical Silurian species. These were the fossils I was so anxious to see at Penzance; and Mr. Peach having obligingly forwarded them to me in London, I no sooner unpacked the box, than I found that true Silurian and even Lower Silurian rocks existed in Cornwall,—the proofs being the presence of certain simple-plaited *Orthidæ*, which are invariably typical of that age. But although Mr. Peach had come to a correct general conclusion, the specific names he attached to the South Cornish fossils in your thirtieth Report are not correct. In respect to the ichthyolites from the slates of Polperro, Pentuan, &c., they have been referred to our mutual friend Sir Philip Egerton, who is better versed in the classification of Agassiz than any of our countrymen, and he thus writes to me concerning them:—"These remains are very enigmatical, and I cannot identify a single specimen with any form I know. I do not think any one of the fragments belongs either to *Cephalaspis* or *Holoptychius*. The nearest approach is to *Bothriolepis*. The dorsal fin named by Mr. Peach *Onchus Murchisoni* (Agass.) is not that species, as far as I can determine from the description of Agassiz, unless it be a more perfect specimen than he has seen. The longitudinal ribs, instead of being uniform (as figured by Agassiz), are notched, more after the manner of *Ctenacanthus*. The other *Onchus* may be *O. tenuiserratus*, but I have not here the means of comparison. From the general appearance of the collection, I should say they differ from any Old Red or Devonian fishes I have ever seen."

If these ichthyolites do not decisively help us to settle the age of the Polperro zone of rocks, they are still of great interest, as being the only group of fishes worth noticing which has been found in the older rocks of Devonshire and Cornwall*, and also as being associated with shells, which Mr. J. Sowerby identifies

* Professor Phillips mentions two very imperfect and doubtful scales of fishes, the one in South Devon, the other in North Devon. Palæozoic Fossils, p. 133, figs. 256, 257.

with the *Bellerophon trilobatus* (Sil. Syst.) and the *Loxomena lincta* (Phillips). The first-mentioned of these shells is characteristic of the tile-stones in Herefordshire and Shropshire, and is also found in strata of the same age in Cumberland (between Kirby Lonsdale and Kendal), which form the uppermost band of the Silurian rocks, or a transition from the Silurian into the Devonian system. Now as Professor Sedgwick and myself had inferred that the limestones of Looe and Fowey belonged to the lower calcareous zone of Devonshire, and as the sections of Sir H. De la Beche show that the Polperro beds dip beneath the Looe and Fowey rocks, the zoological evidences seem to harmonize with recorded physical facts, and we thus obtain reasonable grounds for believing, that the lowest Devonian and the uppermost Silurian strata are exposed in the district which ranges along the shores of that part of Cornwall, by Polperro, Pentuan, &c.

But if doubts should exist as to whether the Polperro slates ought to be referred to the bottom of the Devonian or top of the Silurian system, the discoveries of Mr. Peach in the headland of the Dodman, and in the prolongation of its strata to Veryan Bay, completely demonstrate, that still older and unquestionable Silurian rocks are there present. This is the district in which both Professor Sedgwick and Sir H. De la Beche had noted the existence of a line of elevation*, running from north-east to south-west, which bringing up certain quartzose or argillaceous slates had thrown the beds off, both to the south-east and north-west, the published section of the latter having clearly indicated these relations.

The fossils found by Mr. Peach at Gerrans Bay, as determined by Mr. J. Sowerby, are *Orthis lata*, *O. orbicularis*, another species resembling *O. plicata*, and a fourth which does not appear to have been published. At Caerhayes, Mr. Peach has collected other forms of *Orthidæ*, one of which approaches nearest to the *O. alternata* of the Silurian system. The remainder are not, however, referrible, as he had supposed, to *Leptæna lata*, *Terebratula nucula*, *Atrypa striatula*, &c. The fossils from the Great Peraver quarries in Gorran Haven, on the eastern face of the Dodman, are still more decisive; for the species which Mr. Peach has named *Orthis flabellulum* and *O. testudinaria* both belong, unquestionably, to the *Orthis* (*callactis* B)† *calligramma* (Sil. Syst.), and

* See Trans. Geol. Soc., n. s., vol. v. p. 666; and Report on Cornwall and Devon, p. 84.

† This shell was called *Orthis callactis* B in the Sil. Syst. pl. 19, fig. 5, but subsequent comparisons have shown that it is identical with the *O. calligramma* (Dalman) of Scandinavia, Russia, &c.

In like manner, the *Orthis canalis* of the Silurian system has proved to

with it is a form undistinguishable from the *Orthis* (*canalis*) *elegantula* (Sil. Syst.). The only well-preserved *trilobite* in this rock appears to me to be the *Calymene pulchella*? (Dalman); a second species resembles *C. Blumenbachii.*

No one accustomed to the Palæozoic rocks can throw his eye over the fossils from these three localities, without at once recognising them as true Silurian types. They have an entirely distinct *facies* from the fossils of the overlying Devonian system, and none of the species so abundant in North-western Cornwall are here present. With my imperfect knowledge of the country, it would be premature to say that subdivisions can be established in this highly dislocated region, so as to define Upper and Lower Silurian bands. But it may safely be asserted, that the fossils of Gorran Haven are Lower Silurian types; there being no one species more eminently characteristic of the inferior portion of that system than the *Orthis calligramma*, which in Shropshire and the adjacent Welsh counties is found to range downwards, from the very uppermost beds of the Caradoc sandstone into the heart of the Snowdon slates, and is equally typical of the Lower Silurian rocks of Russia and Scandinavia. At the same time, I do not think that the Gorran Haven beds lie deep in the Lower Silurian group: they probably represent the upper portion only of the Caradoc sandstone; for the *Orthis canalis*, or *elegantula*, and the *Calymene pulchella** (Dalm.), closely allied to *C. Blumenbachii*, are Wenlock, as well as Caradoc, fossils. Judging from the fossils only, I should say that the beds at Gerrans Bay with the *Orthis orbicularis* are younger than those of Peraver and Gorran Haven. Time and careful researches will, however, determine this question of detail, and all I can now express is my opinion, that the quartzose rocks and killas which extend from the tracts above alluded to, to the mouth and centre of the bay and harbour of Falmouth (probably much further to the south-west), are of Silurian age also.

The energy of Mr. Peach having thus afforded us the key by which new lights are thrown upon the succession of Cornish strata, I cannot but hope that, when the government geological surveyors revisit Cornwall, they will define the exact demarcations between these Silurian masses and their overlying Devonian neighbours. In fact, I have within these few days been talking over this subject with my friend the Director-General of the Survey, and he has pointed out to me on his detailed map, how,

be the *O. elegantula* of Dalman; and the names of that author being the oldest, are now necessarily adopted.

* The *Calymene pulchella* (Dalm.) occurs both in the inferior part of the Upper Silurian, and the higher part of the Lower Silurian, in Sweden, Siluria and Wales.

from the enormous flexures which the strata have undergone in their range from Devon into Cornwall, it is highly probable that Silurian rocks (the equivalents of those alluded to) may be recognised in other parts of Cornwall. Thus, the quartzose rocks of Pydar Down or Moor, to the north of St. Columb, which form an east and west axis, dipping to the north and south under fossiliferous Devonian strata, may (he thinks) prove to be also of Silurian age. But, forbearing to speculate on the probable results of future researches, it is my decided belief, that the slaty rocks constituting the great southern headland of Devonshire, at least all the schists, &c. to the north of the Start Point, will eventually be classed with the Silurian group of South Cornwall; for if the Plymouth group of limestones, so prolific in animal remains, afforded us the means of deciphering the age of less clearly developed zones on the same horizon in Cornwall, the Silurian types collected by Mr. Peach may enable us to carry out a more correct classification in still older strata, from Cornwall into the obscure southernmost promontory of Devonshire. In the mean time, confining ourselves to what we now know, it is manifest that Cornwall exhibits in ascending order from north to south,—1st, a band of true Silurian rocks; 2nd, a zone of intermediate character, forming a transition between the Silurian and Devonian systems; 3rd, a copious Devonian system, characterized by lower and upper limestones; and 4th, a limb of the culmiferous or carboniferous basin of Devonshire.

This view will, I trust, be perfectly intelligible to the members of your Society who have occupied themselves with the consideration of this branch of geology, and on which Mr. R. Q. Couch has recently written with perspicuity and talent. I doubt, however, if anything I have stated will make a due impression upon one of that number, my good-humoured antagonist the Rev. D. Williams, whose views of the Cornish succession of strata seem to be opposed to those of all his contemporaries. Geologists, however, who have long lived in Cornwall, and have so well illustrated its mineral structure, will, I am persuaded, be the first to admit the value of the Palæozoic classification, which having been worked out and established in tracts exempt from much dislocation and alteration, has been so applied, as to enable us to interpret the true history of the highly convulsed and metamorphosed rocks of their county. It is, in fact, the greatest triumph which could have been anticipated on the part of those who have steadily proceeded from the known to the unknown.

Looking from your own country to the opposite side of the channel, you are doubtless well-aware that there is the strongest analogy between the slates and granites of Cornwall and those of Brittany and Normandy. Many persons have remarked upon

the strong resemblance between the Mounts St. Michael in the two countries; and no one can have traversed these two regions, without perceiving that, just as they evidently belong to the same mineral type, so are their respective inhabitants descended from a common stock, whose names of places have passed down to their French and English descendants. The existence of Caradoc sandstones and other Silurian rocks in that part of France having been already indicated (Devonian and carboniferous strata being also abundantly developed), their discovery in Cornwall is a happy addition to that union of geological and historical records, by which these widely-separated residences of the Celtic race are illustrated.

With regard to the highly mineralized or metamorphosed conditions of great portions of the killas and sandstone of Cornwall, I can do little more than refer you to the few observations I made at your anniversary meeting, and of which a brief abstract has appeared in your newspapers. There are, as you well said in your anniversary discourse, many analogies between the metamorphic rocks of Cornwall on the one hand and those of Scandinavia and the Ural mountains on the other; whilst the parallel is now drawn closer by the recent discovery of the Cornish Silurian rocks. Your last erupted granites, elvans, and porphyries, have played exactly the same part in traversing your Palæozoic sediments, as like rocks have done in Norway. Cornwall may also be compared to large portions of Siberia, and notably to the Ural mountains, whose chief eruptions have taken place through deposits of Silurian, Devonian, and carboniferous age. In both countries the eruptive rocks are granites, porphyries, greenstones and serpentines: even in their superficial accumulations there is this striking resemblance, that the Cornish detritus and gravel (as clearly pointed out by Mr. Carne) is purely *local*,—the county being quite as exempt from all far-transported materials as the Ural mountains and Siberia. With this absence of all foreign transport or drift, Cornwall is as instructive as the Ural in never exhibiting those "roches moutonnées" and those polished and striated surfaces which have (in my opinion) been so erroneously referred to the action of land glaciers, in all those low regions of the earth, where they have clearly been caused by the action of powerful aqueous drift, in the manner I have elsewhere attempted to explain*.

Your *stanniferous* gravel bears, indeed, precisely the same relations to your granite and killas, as the *auriferous* deposits of the Ural to the eruptive and schistose rocks of that chain. Both are mere local, shingle accumulations, derived from veinstones

* See Russia in Europe and Ural Mountains; and Journal of the Geol. Soc., No. 8.

which have been denuded from the surface of adjacent crystalline rocks. With these analogies there is however a marked distinction between Siberia and Cornwall. All richly auriferous chains (Humboldt first remarked the fact) have a meridian direction, as in the Ural, and various north and south parallel ridges in Siberia and other parts of the globe. The axis of Cornwall, on the contrary, is transverse to that direction, viz. from E.N.E. to W.S.W.; and though containing copper ore in common with the Russian mountains, it differs from them in not producing gold or platinum; whilst it is peculiarly distinguished by containing tin, which is unknown in the Ural. Let us hope that the day is fast approaching, when the cause of the production of such striking phænomena as these will receive some explanation at the hands of those physical philosophers, who are advancing a line of research in which your own countryman Mr. R. W. Fox has already so distinguished himself. But if gold does not exist (in any appreciable quantity at least) in your otherwise richly endowed mineral county, there are, I am happy to say, good grounds for hope, that in their most distant great colony Englishmen may find it abundantly. In an address to the Royal Geographical Society, delivered in May 1845, when commenting upon the valuable labours of Count Strzelecki in deciphering the structure of the great north and south chain which ranges along the eastern shores of Australia, I specially insisted upon its striking resemblances to the Ural mountains, whether in direction, in structure, or in alluvia; remarking, by the way, that *as yet* no gold had been found in this alluvium. I now learn, however, that fine specimens of gold have been found on the western flank of the Australian cordillera, particularly at the settlement of Bathurst, where it occurs in fragments composed of the same matrix (viz. quartz rock) as in the Ural. My friend and associate in the Imperial Academy of Petersburg, Colonel Helmersen, has also recently suggested, that a careful search for gold ore in the Australian detritus will, it is highly probable, lead to its detection in abundance; since the Russians had long colonized the Ural mountains, and had for many years worked mines of magnetic iron and copper in solid rocks, before the neglected shingle, gravel and sand, on the slopes of their hills and in their valleys, were found to be auriferous. If, then, in the course of your statistical inquiries, you may know of any good Cornish miner about to seek his fortune in Australia, be pleased to tell him to apply his knowledge of the mode of extracting tin ore from his own gravel to the drift and debris on the flanks of the great north and south chain of Australia*, or any smaller parallel

* The grand, rich and well-watered region which lies between Moreton Bay on the south and the Gulf of Carpentaria on the north, is that to which

ridges of that vast country; for great would be my pleasure to learn, that through the application of Cornish skill, such regions should be converted into a British "El Dorado."

Requesting you to pardon this little digression, which after all may be turned to profit, and hoping that you will be as proud as I am of the connexion which is now established between Cornwall and Siluria,

Believe me to be, my dear Sir Charles,
Yours most faithfully,
R. I. Murchison.

XXXVII.—*First series of Supplementary Notes to a former Paper, entitled "An Account of some Shells and other Invertebrate Forms found on the coast of Northumberland and of Durham*."* By William King, Curator of the Newcastle Museum.

Having lately read with some attention Professor Edward Forbes's highly philosophical paper on "The Geological relations of the existing Fauna and Flora of the British Isles," published in the first volume of the 'Memoirs of the Geological Survey of Great Britain,' &c., I have been induced to make a few remarks on the depth of habitat of certain species and varieties living on the coasts of Durham and Northumberland.

Professor Forbes divides the bottom of the British seas into four regions or zones according to depth of water and biological peculiarities. "The first or Littoral zone is that tract which lies between the high and low water marks," and inhabited by some common species of *Fucus*, Littorinas, *Purpura lapillus*, &c. "The second or Laminarian zone is that land-encircling belt which commences at low water mark and extends to a depth of from seven to fifteen fathoms. The great tangle sea-weeds form miniature forests in this region," which is also tenanted by Rissoas, Lacunas, *Patella pellucida*, Pullastras, &c. The third is the *Coralline zone*, the vertical range of which is from "fifteen to about fifty fathoms; its chief development between twenty-five and thirty-five

I would specially direct attention, now that its true characters have been opened out to geographers and naturalists by the undaunted and able explorations of Dr. Leichhardt. Some of the tracts recently passed through with so much zeal, by the Surveyor-General of the colony, Sir Thomas Mitchell, may also prove valuable in gold, though they lie further from the axis of elevation. In the mean time, gold ore has been found on the other side of the Australian continent, in the ridges which extend northwards from Adelaide towards the scene of the adventurous and toilsome journey of Major Sturt. These gallant geographers, the pioneers of civilization, are explaining to us the condition of tracts which thousands of our countrymen may soon colonize with the best effects.—London, April 12, 1847.—R. I. M.

* Annals and Magazine of Natural History, vol. xviii. pp. 233—251.

fathoms." It is so termed, because "in it we find the greatest variety and abundance of the corneous zoophytes—arborescent animals, which seem here to take the place of plants. Here we find the great assemblage of carnivorous mollusca, the species of *Fusus, Pleurotoma, Buccinum,*" &c. The fourth is the *deep sea Coral zone,* which ranges from "fifty fathoms to beyond one hundred:" it is "well-characterized by the abundance of the stronger corals," such as *Cellepora* and *Oculina prolifera,* "by a few peculiar *Mollusca,* and by peculiar *Echinodermata,*" &c.

I am not aware that there is any extensive area of sea-bottom on our coasts so deep as the utmost limit here assigned to the *Coral zone,* but there is no doubt that we have the whole of the zones which have just been described.

Had I gone over Professor Forbes's paper when mine was in preparation, I should undoubtedly have given the depths of the severally described *species and varieties,* in accordance with this gentleman's views; for it is remarkable, how strictly their vertical distribution is regulated by the bathymetrical laws he has pointed out.

It will be recollected that most of the forms which I described were stated to be from "deep water;" and that I defined the term in a foot-note as follows: "By the expression 'deep water' must be understood a depth ranging from forty to eighty fathoms. The greatest depth given in Norrie's chart of the North Sea for the trough separating the coasts of Northumberland and Durham from the Dogger and Great Fisher banks, seldom exceeds eighty fathoms." Now this "depth ranging from forty to eighty fathoms" nearly corresponds with Professor Forbes's *Coral zone.*

My former paper contained a description of "two strongly marked varieties" of *Fusus antiquus*: the "thin, short and tumid" variety I have invariably procured from the *Coral zone,* where it lives on *soft ground*; the "thick and elongated" variety inhabits *hard ground* * in the *Coralline zone*: they appear to graduate into each other by a form living at an intermediate depth. The thin tumid variety of *Fusus islandicus* is also from soft ground in the *Coral zone*; and the "thick, long and narrow" variety belongs to the *Coralline zone,* where it occurs on both kinds of sea-bottom. *Panopæa arctica, Natica grœnlandica* and *Retepora Beaniana* appear to be confined to the *Coral zone.* The variety *pelagica* of *Mya truncata* lives in the same region; the normal variety is peculiar to the *Littoral* and *Laminarian zones*; and an intermediate form inhabits the *Coralline.* *Fusus norvegicus, F. Turtoni* †

* The terms "hard ground" and "soft ground" are in common use among the fishermen; the former for a *gravelly, pebbly,* or *rocky bottom,* and the latter for one that is *muddy* or *sandy.*

† I regret that my paper contained no allusion to Mr. W. Bean being the

and *F. berniciensis* have only been procured from the *Coral zone*, or where it merges into the *Coralline*.

Two of the four varieties I mentioned of *Buccinum undatum* are remarkable instances illustrating how different depths of water influence modifications of form: the varieties *magnum* and *pelagicum* are both from soft ground; but the former "lives at depths varying from fifteen to forty fathoms," and consequently belongs to the *Coralline zone*; the latter lives in from forty to eighty fathoms water, and therefore inhabits the *Coral zone*. These variations of depth induce a most remarkable difference in the form of this species: thus *pelagicum* is thin, finely threaded and corded, and in general slightly waved; it has the spire elongated, the epidermis thin and finely ciliated, and the anterior part of the outer lip expanded beyond the termination of the columella*: whereas *magnum* is a thicker, a shorter, and a more tumid shell; it is strongly threaded and corded and prominently waved; its epidermis is thick and clothy; and its columella extends as far forward as the anterior part of the outer lip. Through the kindness of Mr. Pickering of London, I have lately become possessed of a specimen from Newfoundland, the same as the shell which Dr. Gould identifies with the *Buccinum ciliatum* of Fabricius: I cannot but consider it as only a variety of *B. undatum*, and closely allied to *pelagicum*, if not the same: it agrees with the latter in being thin, slightly waved, and in having the anterior part of the outer lip expanded beyond the termination of the columella; but the spire is somewhat less produced, and the whorls are merely threaded: the last character is more strongly marked than in the "simply striated" specimen from Ireland I have spoken of elsewhere (vide Annals, vol. xviii. p. 248). Were I sufficiently acquainted with the *Buccinum ciliatum* of Fabricius, and the *B. Donovani* of Gray, and writing a general account of the varieties of *Buccinum undatum*, it is

first discoverer of *Fusus Turtoni*: this is an omission which remained undiscovered until after my paper was published.

* It is stated by Mr. Albany Hancock, in his "Notes on *Buccinum undatum*" (vide Annals for March), that his *variety* 1. "is occasionally very thin and delicate, and has the spire sometimes considerably produced and the whorls much-rounded. The *B. undatum* of Brown (Illust. Conch. 2nd ed. pl. 3. fig. 2) is an example of the extreme form of this state, which occurs not unfrequently on the Dogger-bank." *Variety* 1. is the same as my *magnum* (Mr. Hancock's specimens were procured from the Cullercoats' cobles that usually fish in from thirty to forty fathoms water; occasionally deeper); and the "*occasionally* very thin and delicate" shells referred to belong to my *pelagicum*, of which hundreds of specimens have now passed through my hands, and all, without exception, were obtained from the Coral zone. The Dogger-bank, which is shallow, and in parts rocky, yields forms as thick and rugged as those inhabiting the Coralline zone.

highly probable that I should be induced to regard these and *pelagicum* as so many forms of the deep-water or *Coral zone* variety: in this case the earlier name of Fabricius would have to be used instead of mine.

But *depth* is not the only element inducive of a varietal difference: the nature of the sea-bottom, whether hard or soft, as is well known to fishermen and many naturalists, exercises a marked influence in this respect. In my paper, as it was read at the Southampton Meeting of the British Association, another variety was described under the name of *crassum*, and which I am disposed to think is represented by the shell figured in Pennant's 'British Zoology,' pl. 73. One of the principal differences between it and *B. magnum* is in the general absence of an epidermis, which, when present, has somewhat the appearance of network, or it assumes the character usual in *littorale*: moreover, it is a thicker, narrower and smaller shell; the whorls are more angulated and more numerous, the aperture is considerably smaller, the canal is narrower, the waves are closer together, more rugose and more angulated, occasionally showing a tendency to become biplicated on the middle of the whorls; the cords are thicker and closer to each other, and the intervening furrows are narrower, rarely having more than one or two threads. Notwithstanding these differences, I have seen specimens which it was difficult to say whether they belonged to *B. crassum* or *B. magnum*. The colour of this variety is generally reddish brown externally, and yellowish white internally; occasionally the outside of the shell is marked with dark brown bands on a light-coloured ground. My largest specimen, which has nine whorls, is $3\frac{1}{4}$ inches long and 2 broad. I possess an interesting specimen (one of the doubtful forms just alluded to) 5 inches long and $2\frac{5}{8}$ broad, and having nine whorls: the first seven whorls have all the characters general to *crassum*; while the last two are covered with an epidermis, and, in other respects, agree with those of *magnum*: I look on this specimen as having been a *crassum* for so long of its existence, and afterwards, perhaps through migrating to *soft* ground, to have become changed into a *magnum*! The variety *crassum* is common on *hard* ground in the Laminarian and Coralline zones on the coasts of Northumberland and Durham, where it ranges from seven to thirty fathoms: it also occurs on the Yorkshire coast; but I apprehend it will be a scarce shell further south, where soft ground is prevalent. I am not yet sufficiently acquainted with rock-inhabiting forms from deeper water, including the Coral zone: from what has passed under my observation, however, I am induced to believe that they approximate more or less to *magnum* and *pelagicum*.

The variety *littorale* lives on hard ground* in the *Littoral* and *Laminarian zones*. It is now my opinion that I was wrong in formerly limiting it to grounds "laid bare at low tides." For some years I have been acquainted with a form of *Buccinum*

* I have been charged with committing "an error" in stating that the variety *littorale* is only found "on pebbly bottoms and rocks." Mr. Albany Hancock, in his "Notes on *Buccinum undatum*," published in the last Number of the 'Annals,' avers, that it "occurs between tide-marks on rocks and *mud*." The statement which I gave is based on my own observations: when living at Sunderland, I often observed specimens of this variety between tide-marks, opposite the Moor, burrowing among pebbles, sand and gravel, and sheltering themselves behind stones and in the crevices of rocks; but I have never seen any on a muddy bottom: that specimens *may occasionally* occur on mud I do not deny, but that such is a regular habitat I am very much disposed to question; for these reasons, that a bottom of this kind, "between tide-marks," could neither afford them shelter from the surge of the shore, nor objects to which they could attach their spawn. Even the *sea-bottom*, inhabited by *magnum* and *pelagicum*, cannot strictly be called *soft ground*, as from the number of stones, and masses of *Modiola vulgaris* that are continually being brought up by the fishing lines, *its* roughness must vastly exceed that of a "*mussel scarp*."

With reference to Mr. Hancock's other charges, I feel it necessary to state the following particulars:—

While Librarian of the Literary and Philosophical Society of Sunderland, and Curator of the Museum in the same town, that is, from 1834 to the close of 1840, I devoted especial attention to the study of recent and fossil shells. By carefully examining for that purpose the cobles and decked boats, and frequently visiting Hartlepool and the whole coast from the Tyne to the Tees, as also joining for some days in a dredging excursion, I procured a great variety of shells, some of which were rare: my finest *Panopæa* was got in 1839. Nor was *Buccinum undatum* overlooked: it was a shell which I always held in particular favour, inasmuch as I believed its various modifications illustrated an early and a favourite speculation of mine as to the genesis of species I repeatedly procured the dwarf whitish variety (*littorale*) at low water opposite Sunderland; the red rock-inhabiting variety (*crassum*) from the crab and in-shore fishing cobles of Sunderland and other places; the large thick-skinned strongly-waved variety (*magnum*) from the Brat nets of the Hartlepool fishermen; and the small thin variety (*pelagicum*) from the decked boats that frequented our deep far-off fishing grounds.

Was it possible then for any one to be thus procuring these widely different forms without being struck with their differences—without knowing something about "their localities and general habits?"—points, which Mr. Hancock, availing himself of the current knowledge of the fishermen as to the depth at which they lived and the nature of the ground they inhabited, "*soon ascertained*" of the varieties which he collected "during a *short* residence at Cullercoats in 1841."

In 1841, having been previously appointed Curator of the Newcastle Museum, I became acquainted with Mr. Hancock, who appeared to be as much interested with the various forms of *Buccinum undatum* as myself. He was then inclined, he stated, to regard the three forms he had collected at Cullercoats as distinct species; but more particularly his *variety* 2. (*crassum*); for this reason, that with only a single exception, he had never seen it but without an epidermis. He further stated to me his intention of pub-

undatum with an unusually thin shell, a remarkably short spire, and very tumid whorls, inhabiting a "mussel scarp" at a depth of from a foot to about two fathoms below low water mark, within the entrance of the river Tees. I have hitherto been disposed to regard this form as a distinct variety; and probably it would have been described as such in my paper had not circumstances prevented me: I now consider however that it is merely a thin form of *littorale*; and hence my reason for extending the vertical range of this variety to the *Laminarian zone*.

The Tees form of *littorale* is exceedingly interesting on account of its confirming an opinion of Mr. J. E. Gray, that "the shells of *Buccinum undatum* and *B. striatum* of Pennant have no other difference, than that the one has been formed in rough water, and is consequently thick, solid and heavy; and the other in *still water of harbours*, where it becomes light, smooth, and often coloured*." It cannot be denied, that the ocean at great depths is "still," and that it is inhabited by thin varieties, *pelagicum* for example: whether the shell figured by Pennant as the *Buccinum striatum* was obtained from the "still water" of the ocean or "of harbours," I cannot say; but I am quite certain, that the

lishing on the subject, as soon as he became satisfied as to the correctness of his views: *it was on this contingency that I understood his publishing to depend.* What I was unacquainted with at the time, was the negative character just mentioned of the variety *crassum*—having been previously led to think that the epidermis was worn off: *this is the only point I will concede to Mr. Hancock, and as such it is duly acknowledged in my paper.*

Five years after the subject had been introduced between us, and finding it necessary to describe my new acquisitions, and conceiving that my views respecting the *number* of varieties of *Buccinum undatum* belonging to our coasts, and the essential characters of these varieties, were different from those I had seen or heard described, I commenced my paper, without ever thinking, that in publishing these views I should be interfering with the publication of Mr. Hancock's, particularly when the publication of the latter depended on a contingency which I saw little or no chance of ever happening. My surprise is certainly great, that Mr. Hancock, after my paper was published, and after leaning to a contrary opinion for nearly six years (up to last August for a certainty), should now "feel satisfied" that his three varieties are "mere varieties."

My paper, as it was read at the British Association, contained the description given in the text of the variety *crassum*, also an acknowledgement to the effect that it was Mr. Hancock to whom I was indebted for the information of its generally being without an epidermis: the descriptive part, I regret, was afterwards cancelled: I was very reluctant to do this at the time, as I felt that this gentleman had no more exclusive right to describe this variety than he had to describe *littorale* and *magnum*, inasmuch as all three had been previously either described or figured by Lister, Pennant, Dr. Johnston and others: nor could I conceive, that his informing me of the general absence of the epidermis in the case of *crassum* prevented me describing it or any of the others.

* Philosophical Transactions, 1833, p. 784.

"still water" of the river Tees is tenanted by a form of *Buccinum undatum* as light and thin as most of the specimens I procure from the depths of the *Coral zone.*

The most obvious difference between the Tees shell and *pelagicum* consists in this, that in the latter the spire is "very long" in consequence of the whorls slowly increasing in diameter; while it is remarkably short in the former, owing to the rapid augmentation of the whorls. It is singular, while *Buccinum undatum* decreases in tumidness in proportion as its depth of habitat increases, that the two species, *Fusus antiquus* and *F. islandicus*, should, on the contrary, become more and more ventricose.

It affords me much pleasure, before concluding the present notes, to mention, that I have lately procured a young specimen of *Buccinum ovum*, Turton (vide Zoological Journal, vol. ii. p. 366. pl. 13. fig. 9). It was brought up by the fishing lines off the coast of Northumberland, from soft ground, in the *Coral zone.* The specimen is half an inch long, and has four whorls, the first two of which have a truncated form: the shell is white, faintly spirally striated and covered with a greenish epidermis. Considering the numerous varieties existing of *Buccinum undatum*, it would not surprise me, if the crag fossil *B. Dalei*, Sowerby, should prove to be the same species: the principal difference between them seems to be in the latter being more strongly spirally striated. Mr. Morris, however, informs me, that the striation of *B. Dalei* is a variable character, which is proved by some unpublished figures of this species that he has kindly favoured me with. An examination of more specimens, than I possess, of both forms is necessary, however, before deciding as to their specific identity. Probably, the ordinary specimens of *B. Dalei* lived in the Coralline zone, which will account for their being thicker than those of *B. ovum*, judging of my specimen, and the one figured by Dr. Turton. In both forms, the termination of the left side of the canal is slightly tongue-shaped.

BIBLIOGRAPHICAL NOTICES.

Outlines of Structural and Physiological Botany. By Arthur Henfrey, F.L.S. &c. 12mo. Van Voorst, 1847. Pp. 245, 18 plates.

Much has been done of late years in this country to aid students in the prosecution of botany. The valuable Introductions of Lindley and Gray are now in the hands of all, and when combined with Babington's excellent 'Manual' they form a complete text-book for the British botanist. Nevertheless we hail the appearance of Mr. Henfrey's work as one which has been ably executed, and in a manner somewhat different from that adopted by the other authors

alluded to. The "Outlines" are confined entirely to *structural* and *physiological* botany without reference to classification. They contain many interesting original observations, and they give a condensed view of the state of botanical knowledge at the present time, to the exclusion of all theories which have been abandoned or advanced without sufficient grounds. The book is thus confined within a moderate compass, and the student is at once put in possession of the great leading facts of the subject unencumbered with the statement of numerous opinions.

The author commences with a consideration of the chemical constituents of vegetables, and then proceeds to the elementary structure, or the cells and vessels of plants and their functions. His remarks on cytogenesis are well worthy of attention. There are three theories of cell-development which he considers worthy of notice:—

"1. The formation of free cells from nuclei, in the cavity of the parent-cell: this view was proposed by Schleiden.

"2. The formation of new cells by the division of the mucilaginous investment of the interior of the cell (primordial utricle) into two or four perfect, closed sacs, *around* and *by* the whole outer surface of which a new layer of membrane is simultaneously formed for each portion, these constituting the new cells. This is the theory of Nägeli.

"3. The gradual division of the primordial utricle into two portions by an annular constriction and infolding, the fold growing inward to the centre, and a layer of permanent cell-membrane being also deposited by each lamella of the fold, gradually from the circumference to the centre. This view was advocated by myself as the *universal* mode of cell-formation, in a paper read before the British Association at Cambridge last year, and has been more fully developed in a recent memoir by Mohl."

In speaking of the functions of what have been called *milk-vessels* he says, "They may be regarded as intercellular passages containing peculiar secretions not essential to the *life* of the plant. The pretended circulation of the latex was a groundless hypothesis and arose from erroneous observation." He thus differs completely from Schultz, and believes with Mohl, that the gravitation of the fluids when the vessels are cut is the cause of the motions observed. In treating of the mode in which woody matter is formed, he seems to discard the theories of Petit Thouars and Gaudichaud as reared on erroneous foundations. At p. 54 he remarks, "Each vascular bundle (of a monocotyledonous stem) originates at the point where the new leaf or phyton is developed out of the nucleus of cellular tissue at the apex in the centre, and is gradually elongated into an ascending portion which passes upward into the petiole, and into a descending portion which passes outward and downward a little above the ascending bundle of the leaf below. It must not be imagined however that the *descending fibres break through* the cellular tissue; no interruption of continuity takes place within the stem; the vascular bundle is formed out of cells *in the place where it is subsequently found*,

in consequence of the law of development of the plant. We say that the fibres *descend*, because the middle portion is that which first becomes distinctly developed into a vascular structure."

When considering the physiology of vegetation, the author alludes to the function of spiral vessels, and differs from those who look upon these vessels as formed for the special purpose of conveying air. In their earlier developing condition they are full of fluid, and "it appears probable," he says, "that their office, like that of the other vascular and fibrous tissue, is to give strength to the parenchyma, and they are peculiarly adapted to the requirements of the tissue in which they are found. Their structure is that which gives the greatest strength and elasticity consistent with lightness. This is a sufficient explanation of their predominance in those parts where the tissue is most delicate and the growth most rapid. The medullary sheath is of course, in this view, regarded as adapted peculiarly to the early, developing condition of the pith."

The process of respiration and assimilation in plants, according to the author, "consists of the production of a proteine compound, by the agency of light, from the crude juice consisting of water holding in solution carbonic acid and ammonia. When the light is freely admitted to act, as is the case in the usual condition of plants, the assimilating process preponderates in activity over the developing power, and the excess of nutriment not being required for immediate use is deposited as starch instead of cellulose; the deoxidating process still continuing, this starch, also receiving in the process a small quantity of nitrogen, becomes chlorophylle. Should the light be intercepted now, we shall have a retrogressive series of processes; the chlorophylle will disappear, since the respiration is reduced to such a low degree that all the carbon is required for development; the plant continues to grow for a time, its tissues weak and succulent, till all the assimilated carbon having been consumed in the production of new structures, the plant dies of starvation."

The consideration of the reproductive organs and their functions necessarily occupies a large portion of the work, and the morphological views of structure are brought forward in a lucid and interesting manner. After stating the opinions relative to marginal and axile placentation, he concludes thus:—

"As the question stands at present, we are led to prefer the theory of carpellary placentation by the evidence afforded by the *parietal* form as occurring in Violaceæ, Papaveraceæ, Orobanchaceæ; the *axile* placentas of Scrophulariaceæ, Ericaceæ, &c. appear to admit of an explanation by both views, as do also the *central* placentas of Caryophyllaceæ. The central placenta of Primulaceæ and Santalaceæ favours the idea that the placenta is a prolongation of the axis, and can only be explained by the carpellary hypothesis, by supposing that the central placental column is a *confluent whorl of placental processes developed separately from the carpels through a process of deduplication.*"

The obscure subject of fertilization receives considerable attention,

but the author confesses that he is as yet unable to come to any definite conclusion on the point. The important facts however, so far as they are known, are well stated.

The work concludes with remarks on physiological phænomena of a general nature, including the colour, light, and motions of plants.

The plates are from drawings by the author, and they are executed in a clear and correct manner.

We have no hesitation in recommending this work to the attention of all students of botanical science. The conciseness and clearness of the descriptions, the accuracy of the views, and the philosophical spirit which pervades the whole work, deservedly place it in a high rank among the elementary botanical treatises of the present day.

Supplement to English Botany.

It is long since we have called attention to this valuable and most beautiful work, and therefore now repeat our earnest call upon all our botanical readers to extend their patronage to it. We do this the more earnestly because we know that it is in great want of that support which it has so good a right to expect, for at the present time "the sale barely repays the money expended upon print and paper, the proprietor being himself the artist and engraver." From this cause much irregularity has attended its publication, but it is now the intention of Mr. J. W. Salter, the son-in-law of Mr. Sowerby, who has undertaken its management, to issue it regularly on the first of every third month, with six plates in each number instead of four.

Mr. Salter states that he is "favoured with the support and encouragement of those distinguished botanists whose assistance has conferred so much value upon the work," and that "he has every reason to hope that the descriptive part of future numbers will not be inferior to that which has already appeared." We feel confident that such will be the case, and may add concerning the plates, that no better, even if equally good, representations of plants are to be found in any work of science or art. The drawings and engravings will be made by Mr. Sowerby and Mr. Salter, the persons from whose hands the illustrations in former numbers have proceeded.

We have now before us two numbers published since the issue of the prospectus from which we quote, and can safely state that they are fully equal to their predecessors; they are numbered 68 and 69, being 12 and 13 of the new series, no part of which will be included in the "small edition" lately issued by the proprietors of the original work. Amongst the plants figured in them are *Lamium intermedium*, *Hieracium Lapeyrousii*, *Statice rariflora*, beautiful plates both botanically and artistically; also *Poa Parnellii* and *P. Balfourii*, new grasses which are well represented; and in addition several interesting cryptogamic plants.

When we remember the very numerous copies which have been purchased of the original work and the "small edition," it is unaccountable to us that this supplement (an essential appendage to either of them) has obtained so little support.

Cybele Britannica; or British Plants and their Geographical Relations. By H. C. Watson. London, Longmans. 8vo.

We have just received the first volume of this valuable work, and hasten to notice it. Its author is too well known for the success with which he has studied the geographical relations of British plants to require any praise from us, and perhaps we need only state that the present work is, in our estimation, far superior to either of his former publications. We have not room for long quotations—indeed they are unnecessary, since the book must soon be in the hands of all botanists. The "Introductory explanations," as they are denominated, extend to 69 pages, and seem to us a very complete statement of the plan upon which a work on the geographical distribution of the plants of a single country should be elaborated. He divides the whole of Great Britain into regions both of space and elevation, points out the peculiarities of each of them, and explains the reasons for their adoption. But all must refer to the work itself.

The geography of British plants was quite a new subject when first taken in hand by Mr. Watson, and he is well-deserving of congratulation upon the publication of the work now before us, in which he shows a complete knowledge of his subject—far more complete than is possessed by any other person.

We trust that the success of this volume will encourage him to proceed rapidly with the preparation of its successors; and that the time may at length arrive when similar information may be obtained in reference to Ireland, for much must be done before the attempt at illustrating the distribution of its plants can be made with any reasonable prospect of success. Let Irish botanists see to this.

Works in the Press.

We are informed that the sixth edition of Dr. Mantell's 'Wonders of Geology, or a Familiar Exposition of Geological Phænomena,' is in the press, and will shortly appear in one volume uniform with the Author's 'Geology of the Isle of Wight,' with many new illustrations.

We have also much pleasure in announcing that a Second Edition of Babington's 'Manual of British Botany' will be published in a few days.

PROCEEDINGS OF LEARNED SOCIETIES.

LINNÆAN SOCIETY.

December 15, 1846,—E. Forster, Esq., V.P., in the Chair.

Specimens of *Juncus diffusus*, Hoppe, collected by John Ansell, Esq., at Darman's Green near Hoddesdon, Herts, were exhibited and presented.

Read the conclusion of Dr. Hooker's memoir "On the Vegetation

of the Galapagos Archipelago, as compared with that of some other Tropical Islands and of the Continent of America."

The present paper offers the deductions which Dr. Hooker has drawn with reference to Botanical Geography from his "Enumeration of the Plants of the Galapagos Islands," read during the previous session. He regards the relationship of the Flora to that of the adjacent continent as double; the peculiar or new species being for the most part allied to plants of the cooler parts of America or of the uplands of the tropical latitudes, while the non-peculiar are the same as abound chiefly in the hotter and more humid regions, such as the Islands of the West Indies and the shores of the Gulf of Mexico; and while on the other hand many of the species, and those the most remarkable (as is likewise the case with regard to the Fauna), are confined to a single islet of the group, and often represented in other islets by similar, but specifically very distinct, congeners.

The author commences his memoir with an account of the geographical position, and of some of the most important features of the climate and soil of the Archipelago, chiefly derived from the journals of Mr. Darwin and of some other voyagers, including the unpublished journal of the late Mr. T. Edmonstone. This is followed by an Enumeration of the Naturalists who have explored it in the order of the dates of their respective visits, including Mr. Cuming, Mr. David Douglas, Dr. Scouler, Mr. Macrae, Mr. Darwin, Admiral Du-Petit-Thouars and Mr. Edmonstone. The total number of species brought together from these various sources amounts to 244, of which 202 are flowering plants and 28 ferns. All of these, excepting perhaps 17, natives of Charles Island (the only inhabited one), are truly indigenous, but it is probable that this is only an approximation to the true number. Under any circumstances, however, the Flora is extremely poor when compared with that of other tropical islands of equal, or even of smaller, extent; the Cape de Verd Islands, scarcely so well explored, yielding upwards of 300 species on a soil quite as sterile; and the Sandwich and Society groups being very much richer, although further detached from any great continent.

Dr. Hooker next proceeds to review the Flora under three distinct heads; first with reference to the proportion borne by each of the principal Natural Orders to the whole Flora, and its relations to the Flora of the neighbouring continent and of other islands somewhat similarly circumstanced. Secondly, he treats of the Flora of the Galapagos as divisible into two types; the West Indian (including Panama), to which the plants common to other countries and some dubious species almost universally belong; and the Mexican and temperate American, or that under which the great majority of the peculiar species rank. Thirdly, he notices the most singular feature in the vegetation of the group, namely that the several islets are tenanted for the most part by different species, many of which are, however, represented by allied species in one or more of the other islets. Under each of these heads Dr. Hooker enters into minute statistical details, accompanied by extensive research and careful comparisons.

Read also a "Description of a new species of *Cowry*." By G. B. Sowerby, Esq., F.L.S. &c. &c.

CYPRÆA VENUSTA, testâ ovato-ventricosâ utrâque extremitate anticâ præcipuè subrostratâ, dorso gibboso carnicolore maculis pallidè castaneis notato, lateribus basalibus incrassatis carnicoloribus, extremitatibus pallidè castaneis roseo-tinctis, basi subplanulatâ albicante extremitatibus carnicoloribus, spirâ validâ obtusâ anfractibus duobus, aperturâ elongatâ angustâ rectiusculâ intùs roseâ posticè in canalem brevem sinistralem exeunte anticè subflexuosâ, canali anticâ brevi rectiusculâ paululùm deflexâ, dentibus labii externi circa 25 magnis interstitiis æqualibus rotundatis; labii interni paucis (circa 16) majoribus distantibus anticis maximis medianis ferè obsoletis, cavitate columellari parvâ albâ.

A very handsome Cowry, of which a single specimen has lately been received from Port Adelaide, South Australia.

January 19, 1847.—E. Forster, Esq., V.P., in the Chair.

Mr. Ward, F.L.S., exhibited a fine series of specimens of *Adiantum Capillus Veneris*, L., together with a specimen of *Asplenium Trichomanes*, L., collected in Italy by Mr. E. W. Cooke, the latter bearing on several of its pinnæ sori taking their origin from the upper as well as from the lower surface of the frond; and also a portion of a large branch of a Scotch Fir hollowed out by hornets to form a nest, and beautifully exhibiting in the dissected parts the origins of the smaller branches.

Read a paper "On the Natural History, Anatomy, and Development of *Meloë* (second memoir)." By George Newport, Esq., F.R.S. &c. Communicated by the Secretary.

Mr. Newport states at the commencement of his paper, that his present object is to compare the habits and anatomy of *Meloë* in its larva state with those of the larvæ of allied genera, and with the parasitic groups of insects the *Strepsiptera* and *Anoplura*, with a view to show that habit and instinct in animals are always closely associated with the functions of particular organs, and seem to be the immediate result of structural peculiarities of organization.

Having in his former memoir described the habits of *Meloë*, and traced the young from the egg to the imago state, he now entered on an examination of the habits of the entire group of insects allied to *Meloë*, and showed that the whole of them in their larva state bear a general resemblance to the larva *Meloë*, not only in their organization but also in their habits; and that the more closely the larvæ of different genera approach in structure, the more nearly also are they allied in instinct and œconomy. This accordance between structure and instinct he regards as universal throughout nature, and as particularly marked in the *Articulata*. The author believes that, by carefully comparing our observations on the natural history of animals with their peculiarities of structure, and these on the other hand with their instincts, what might otherwise remain useless and isolated facts may be rendered truly important to science, "as data on which a correct knowledge of the laws of creation and life may

be established." In this way, he states, "natural history may be made to occupy its proper position as an important branch of useful knowledge, and mainly help to demonstrate the connexion which subsists between structure and function, and function and the habits of animals."

In pursuing this view, he shows that the organization and instinct of the larva *Meloë* closely agree. At the moment of birth, when the larva is destined to attach itself parasitically to the *Hymenoptera* which alight on flowers to collect pollen, and which are to convey it to their nests, its organs of vision are largely developed, and those of locomotion are elongated, powerful, and constructed like those of the parasitic *Anoplura*; and it is extremely active and sensitive of light. But when, at the period of full growth, it is found in the cell of *Anthophora*, it is a fattened, yellow-coloured, almost motionless larva, with its legs atrophied and reduced to mere pedal tubercles previous to a further change in their structure when the larva passes to the state of nymph.

In the course of these observations Mr. Newport proved, by actual comparison, the identity of many yellow-coloured larvæ which had been taken by Mr. Smith on some of the *Nomadæ* (themselves parasitic insects) with the larvæ of *Meloë*, which he had himself reared from the eggs, thus establishing the fact of the parasitic attachment of *Meloë* to perfect *Hymenoptera*. The genera allied to *Meloë* (*Mylabris*, *Lytta*, *Tetraonyx*, *Sitaris* and *Apalus*), and those of allied families, *Horia*, *Cipiter*, *Rhipiphorus*, *Symbius* and others, were all shown to bear a more or less close relation to *Meloë* in the habits or the structure of their larvæ. *Sitaris* was especially referred to, on the observations of Audouin and Pecchioli, as affording close similarity to *Meloë* both in structure and habit, this species having already been found by the former naturalist in the nests of *Anthophora*.

Mr. Newport then traced the history of the *Strepsiptera* as now ascertained by the labours of Siebold, most of whose observations he has confirmed, and he showed some remarkable coincidences between the structure and habits of the extremely minute larvæ of these insects and those of *Meloë*. The chief of these are their parasitism on the *Hymenoptera*, and the atrophy of their limbs after they are located in the nests of their victims. So extremely minute are the young *Stylops* shortly after their birth, that on measuring several, while living, on a micrometer plate, Mr. Newport found that each individual does not exceed twenty-two thousandths of an inch in length: yet internally this minute object is as fully organized as other insects. He then showed that what had been regarded by Dr. Siebold as a cæcal termination to the alimentary canal is in fact a reduplication of part of that organ, which after folding twice on itself is continued to the anal segment as in other insects. He also described the imago of this species of *Stylops*, which, as well as its larvæ, had been obtained from the bee, *Andrena Trimmerana*, and pointing out in what it seems to differ from *Stylops melittæ*, he proposed to describe it as *Stylops aterrimus*.

Comparing the male *Stylops* with the female, Mr. Newport remarked especially on the peculiar organization of the former, as fitted for special instincts, perfection of vision and celerity of flight, conjecturing that the object of this in *Stylops* may be the detection on the wing of those *Hymenoptera* which carry about with them through the air the apodal female that awaits impregnation; and showed that all we yet know of the habits of *Stylops* is conformable to this view.

Returning then to the consideration of *Meloë*, the author showed that notwithstanding the structures with which it left the egg are fully developed, they are so on an inferior type of organization, like *Stylops* and like the *Anoplura*. The eye, although large and highly sensitive to light, is still but a single ocellus, fitted only for near vision. The limbs although strong are unguiculated, like those of the *Anoplura*, and fitted for clinging rather than for regular progression; and its mandibles, retaining the jointed, pediform structure of the corresponding organs in the carnivorous *Chilopoda*, are fitted for piercing soft structures, rather than for triturating or for incising their food. This fact, overlooked by the author in his former memoir, now induced him to believe that the young *Meloë* pierces and preys on the bee larva rather than that it subsists on its food. This he believes also may hereafter prove to be the true habit of the larva of most of the allied genera.

Specimens of the larva and imago *Stylops*, and of the larva, nymph and imago *Meloë*, were on the table for inspection.

ZOOLOGICAL SOCIETY.

January 26, 1847.—George Gulliver, Esq., F.R.S., in the Chair.

The following communication was read:—

DESCRIPTIONS OF SIX NEW SPECIES OF AUSTRALIAN BIRDS. BY JOHN GOULD, F.R.S.

CYSTICOLA LINEOCAPILLA, Gould. *Cys. rufa; plumis capitis et dorsi latè conspicuèque per mediam longitudinaliter nigro-fusco striatis; rectricibus maculâ albâ infra ornatis.*

General plumage pale rufous, with broad and conspicuous striæ of blackish brown, forming lines down the centre of the feathers of the head and back, the under surface fading into white on the throat and centre of the chest; tail-feathers with a conspicuous blackish spot on the under surface near the tip; irides light reddish brown; bill and feet flesh-brown.

Total length, $3\frac{3}{4}$ inches; bill, $\frac{1}{2}$; wing, $1\frac{4}{8}$; tail, $1\frac{7}{8}$; tarsi, $\frac{5}{8}$.

Hab. Port Essington.

Remark.—Nearly allied to *C. exilis.*

MIRAFRA HORSFIELDII, Gould. *Mir. cinerea; mediis plumis, capite, dorso inferiore, alisque, fuscis; alis albo-marginatis; gulâ serie macularum intensè fuscarum semilunari ornatâ.*

General plumage ashy brown, with the centre of the feathers dark brown, the latter colour predominating on the head, lower part of

the back and tertiaries; wings brown, margined with rufous; over the eye a stripe of buff; chin white; under surface pale buff; throat crossed by a series of dark brown spots, arranged in a crescentic form; under surface of the wing rufous; bill flesh-brown at the base and dark brown at the tip; feet fleshy brown.

Total length, $5\frac{1}{2}$ inches; bill, $\frac{1}{2}$; wing, $2\frac{7}{8}$; tail, $2\frac{1}{8}$; tarsi, $\frac{7}{8}$.

Hab. Interior of New South Wales.

Remark.—Nearly allied to, but smaller than, the *Mirafra Javanica* of Dr. Horsfield.

Amytis macrourus, Gould. *Amy. corpore superiore fusco; plumis singulis lineâ angustâ albâ longitudinaliter per mediam ornatis; corpore inferiore nec aliter nisi pallidius picto; scapulis infra rubiginosis; caudâ fuscâ brunneo-marginatâ.*

Upper surface brown, each feather with a narrow stripe of white down the centre; under surface the same, but much paler; under surface of the shoulder pale rusty red; tail brown, margined with pale brown; irides hazel; base of the lower mandible horn-colour, remainder of the bill black; feet flesh-brown.

Total length, 7 inches; bill, $\frac{1}{2}$; wing, $2\frac{5}{8}$; tail, $4\frac{1}{4}$; tarsi, 1.

Hab. Western Australia.

Remark.—This is a more robust species than the two previously known, viz. *A. texilis* and *A. striatus*, from which it may also be distinguished by the much greater length and size of the tail.

Sericornis maculatus, Gould. *Ser. corpore superiore, alis, caudâque, fuscis; caudâ ad apicem latâ fasciâ nigro-fuscâ transversim ornatâ; rectricibus externis vix albo ad apices notatis; alis spuriis nigris; internis pennarum pogoniis albo-marginatis; corpore inferiore griseo-albo.*

Upper surface, wings and tail brown, the latter crossed near the tip with a broad band of blackish brown, and the outer feathers slightly tipped with white; forehead and lores deep black; stripe above and a small patch below the eye white; spurious wing-feathers black, margined on their inner webs with white; under surface in some greyish white, in others washed with yellow; the feathers of the throat and chest spotted with black on a light ground; irides greenish white.

Female.—Differs in having the lores brown, and in being somewhat smaller than the male.

Total length, $4\frac{1}{2}$ inches; bill, $\frac{5}{8}$; wing, $2\frac{1}{8}$; tail, 2; tarsi, $\frac{7}{8}$.

Hab. Western and Southern Australia.

Sericornis osculans, Gould. *Ser.* (Mas) *corpore superiore, alis caudâque brunneis; rectricibus, duobus intermediis exceptis, fasciâ nigrâ ad extremitatem ornatis; alis spuriis nigris albo-marginatis; gulâ et medio abdomine albis, griseo vel flavo tinctis; paucis oblongis maculis in gulâ nigris.*

Male.—Upper surface, wings and tail dark brown, all but the two centre feathers of the latter crossed by a band of black near the extremity; spurious wing-feathers black, margined with white; lores black, above which on each side a patch of white continued in a fine

line over the eye; throat and centre of the abdomen greyish white in some and yellowish white in others, marked with a few oblong black spots on the throat.

Female.—Somewhat smaller in size, and with the lores brown instead of black.

Total length, $4\frac{1}{2}$ inches; bill, $\frac{5}{8}$; wing, $2\frac{1}{4}$; tail, 2; tarsi, $\frac{7}{8}$.

Hab. South Australia.

Remark.—Intermediate in size between *S. frontalis* and *S. humilis.*

Sericornis lævigaster, Gould. *Ser. corpore superiore fusco; caudâ, ad apicem gradatim nigricante, in apice albâ; alis spuriis brunneis, pogoniis quarum internis albo-marginatis; corpore inferiore cervino lavato.*

Upper surface brown; tail deepening into black near the extremity and tipped with white; spurious wing-feathers dark brown, margined with white on their inner webs; lores and mark under the eye brownish black; above the eye an indistinct line of white; under surface washed with yellowish buff; irides greenish white.

Female.—Smaller than the male, and with the lores pale brown.

Total length, $4\frac{1}{4}$ inches; bill, $\frac{5}{8}$; wing, $2\frac{1}{8}$; tail, 2; tarsi, $\frac{7}{8}$.

Hab. Interior of Australia, near the Gulf of Carpentaria, where it was discovered by Mr. Gilbert.

Remark.—Nearly allied to *S. frontalis.*

February 23.—William Yarrell, Esq., Vice-President, in the Chair.

The following communications were read:—

1. Observations on Struthionine Birds in the Menagerie at Knowsley. By The President.

I shall take this opportunity of noticing some of the differences which appear to me to characterize the Struthious tribe in their breeding, and which I rather think are not generally known.

I believe the general supposition to be, that no difference exists, and that they agree at this period with most of the Rasorial birds in being polygamous; but this is by no means the case.

What may be the truth with the head of the Family, the *African Ostrich,* we have had too few opportunities or means of judging. The *Emu* is strictly monogamous; and the male, who attends to the eggs, by no means approves of any other female than the favoured one coming near the nest.

The *Rheas,* on the contrary, are clearly polygamous; and with them the male not only selects the place for and forms the nest, but actually collects together in it the eggs* (which are frequently laid at random about the enclosure), in order that he may incubate them. He shows no signs of anger when the females approach, and in one instance two females have laid in the same nest. By analogy we may perhaps suppose that the Ostrich follows a similar plan.

* The manner in which this operation is accomplished is by inserting the beak between the egg and the ground, and rolling it along by the assistance of his long neck, exactly in the way that a boy would roll a cricket-ball along by the aid of a long stick with a hooked end to it.

There are differences also in their modes of copulation. If my memory does not deceive me, the *Struthio Camelus* does not, like other birds, mount on the back of the female, but merely places one foot on her back, the necks of the pair twisting about all the while like two snakes, but without holding.

The *Rhea*, on the other hand, seizes hold of the back of the neck; and the *Emu*, I think, is the one which straddles over the female during the operation with his legs on each side of her.

The Rhea lays from fourteen to twenty-five eggs; the Emu from twelve to seventeen.

2. Description of a new Rat from South Australia. By J. E. Gray, Esq., F.R.S. &c.

Mus vellerosus. *M. brunneus, albido-varius, ad caput obscurior; vellere prælongo, denso; pilis mollibus ad basin fusco-brunneis, inde pallidioribus, ad apicem albis; codario mollissimo, brunni-plumbeo; caudâ annulatim squamatâ, raris brevibus et rigidioribus setis obsitâ; auribus mediocribus, rotundatis.*

Hab. in campis Australiasianis inter fluvios Murray et Glenelg.

The skull resembles the typical Rats. The cutting teeth are yellow, moderate, slightly rounded in front, without any regular groove. The grinders are $\frac{3}{3}$, worn; the anterior upper oblong, formed of three transverse folds, the hinder being smallest; the second tooth is nearly circular, formed of two folds, the front fold largest, and having a notch on its inner side; the third tooth small, half ovate, with two notches on the inner side. The anterior lower grinder is formed of three, and the others of two folds; the anterior fold of the last tooth having a slight notch on the inside, and the posterior fold being smaller than the rest.

	in.	lin.
Length of skull	1	9
——— tooth-line	0	4
Total length	7	6
Tail	4	6

This rat has the dentition and somewhat the general appearance of *Mus fuscipes*, Waterh., but the skull and animal are considerably larger, and the fur is very much longer and paler.

The specimens from which this description is taken were sent to the British Museum by His Excellency Capt. Grey, Governor of New Zealand.

3. On two new Genera of Certhinæ. By G. R. Gray, Esq., F.L.S. &c.

I beg to lay before the Meeting the following description of what I believe to be a new genus belonging to the subfamily *Certhinæ*, under the name of *Caulodromus*.

Rostrum capite longius, latum, basi subdepressum, gracile, per totam longitudinem curvatum, lateribus a naribus usque ad apicem obtusum subemarginatum fortiter compressis. *Gonys* longus cur-

vatus. *Nares* laterales, anteriùs in sulco brevi lato siti, aperturâ magnâ rotundatâ nudâ. *Alæ* breves, basin caudæ operientes, fortiter rotundatæ, remige sextâ omnium longissimâ. *Cauda* brevissima, rectricum apicibus subacutis. *Tarsi* digito medio breviores, anticè squamis latis transversis muniti. *Digiti* longi, graciles, extimo quam intimo longiore basi coadunato, intimo basi vix coadunato; postico longo, ungue longo curvato armato.

Caulodromus Gracei. *Caul. rufescens, plumarum scapis strigâ rufo-albidâ notatis, pogoniis interioribus in dorso nuchâque nigris; tectricibus caudæ superioribus inferioribusque læte rufis, alis caudâque saturatè brunneis strigis duabus nigris alterâ à rictu alterâque (breviusculâ) à rostri basi ductis, gulâ pectore abdomineque medio rufescenti-albis rufo-brunneo variegatis.*

Rufous brown, streaked narrowly down the shaft of each feather with rufous white; the inner web of the feathers of the back of neck and back black; the upper and under tail-coverts bright rufous; the wings and tail dark brown; two streaks of black, one from the gape and the other (rather short) from the base of the bill; the throat, breast and middle of the abdomen rufous white, varied with rufous brown.

Total length, 5 inches; bill, from gape, 1 inch; wing, 2 inches 2 lines; tarsi, 1 inch.

This proposed division differs from the typical form of *Certhia* by the length and form of the bill and the position and form of the nostrils, while the extreme shortness of the tail at once points out a great dissimilarity from those species that properly belong to the abovementioned genus.

I have also before me another bird that appears to belong to the same subfamily, which I shall form into a distinct genus, under the name of

Salpornis.

Rostrum longum latum basi subdepressum, per totam longitudinem curvatum; lateribus à naribus fortiter compressis. *Gonys* elongatus, curvatus. *Nares* laterales, anticè in sulco lato brevi siti, aperturâ magnâ nudâ. *Alæ* longissimæ, usque ad caudæ apicem ferè attingentes, acutæ, remige primâ brevissimâ, secundâ ferè longitudinis tertiæ quartæque, quæ æquales et omnium longissimæ. *Cauda* breviuscula, quadrata, rectricum apicibus rotundatis. *Tarsi* medio digito breviores, squamis latis muniti. *Digiti* longi, fortes, intimo quam extimo breviore basi parùm coadunato, extimo longius coadunato; postico longo, forti, ungue curvato armato.

The type of this proposed genus is already described by Major Franklin in the Proceedings of the Society under the name of *Certhia spilonota* (Proc. 1831, p. 121).

The differences exhibited between this and the former genus are at once seen in the form of the wings, which are lengthened and pointed, and of the tail, which has the ends of the feathers slightly rounded. These characters are like those of *Tichodroma*, while the

form of the bill and feet are similar to those of the genus proposed above.

The specimen of *Caulodromus* was kindly lent me by J. R. Grace, Esq., who procured it in Darjeeling: that of *Salpornis* was presented by B. H. Hodgson, Esq. to the British Museum, and forms part of a collection from Behar.

MISCELLANEOUS.

Microscopic Anatomy of the Shell of the Decapodous Crustacea. By J. Lavalle.

From my observations, says the author, the tegumentary apparatus of the *Crustacea* may be divided into two parts: 1st, an exterior one, which is incrusted with calcareous salts, and has no apparent vessels; it is the carapace, the shell properly so called; it alone forms the solid skeleton of the animal, and its inextensibility requires it to be shed at certain periods, to be replaced by a larger covering. 2nd, the other, situated in the interior, covers the first at all points: it is soft and highly vascular, it remains after the shedding of the tegument, and appears to be especially destined to reproduce a new one.

My observations apply to the shell alone, to that portion of the tegumentary apparatus which is cast annually, and I have purposely limited the subject, because it has been hitherto almost impossible to base a sufficiently settled opinion upon the nature of this coriaceous and hardened covering.

The solid portion of the tegumentary apparatus of the decapodous *Crustacea* which is shed differs essentially from shells, in one thing, that when treated with an acid it parts with its carbonate of lime without its organization being any way changed. In this respect it may be compared to the bones of the vertebrate animals.

The shell constitutes a covering of a single piece, continuous throughout, and which is only interrupted on the level of the natural openings. The flexible points, and the softest parts of this envelope differ from the solid parts only in the absence of calcareous salts; their organization is perfectly identical. The articulations are only more or less complicated, but often very simple folds, of this covering. It is the same with the ossiform parts placed withinside the organs, and designed for the insertion of the locomotor muscles. The parts destined to break or grind the food are only more solid parts of the shell and of a denser texture. At the time of shedding, all these parts are cast off together. The shell presents, in the most perfect state, three layers quite distinct and easily separable:—The most external, homogeneous, transparent and corneous one, presents an opening only for the passage of the hairs or analogous organs, and covers the whole shell with a varnish often extremely thin; it is evidently analogous to the epidermis of the higher animals; I have designated it by the name of *epidermal layer*. The central layer is

especially destined to contain the colouring matter of the shell; it has a peculiar organization, and always contains the base of the hairs and the corneous tubercles: this is the *pigmental layer*. The internal layer is much the thickest, and constitutes nearly the whole shell; in it are found the passages of the hairs, tubercles and spines, as well as a great number of small irregular bodies of an organic nature: this is the *dermal layer*.

These two last layers are the only ones in which the carbonate of lime is deposited; they have a nearly analogous organization. Under a weak magnifier, we ascertain that they are formed throughout of extremely fine and delicate lines, whose general and striking characteristic is that they are constantly parallel. This organization exists in the great majority of cases, and we remark that, when it is absent, or difficult to detect, the dermal layer presents iridescent tints, often as brilliant as those of the most beautiful shells (the *Anomouri*). These lines are not produced by independent and superposed layers, for the shell is not separable into laminæ corresponding to these lines. By means of a very high magnifying power we can perceive that these lines form part of one whole. The intimate organization of the shell therefore presents itself under three principal forms: 1st, we only find extremely thin filaments, joined to one another and directed from within outwards, perpendicularly to the surface; these filaments, becoming thicker and more opake at similar levels, give an appearance of parallel lines: 2nd, these filaments exist, but are traversed at right angles and along parallel zones, by other bundles of filaments; from these last issue ramifications which anastomose with the adjacent zones and thus reunite all the bundles: 3rd, the perpendicular filaments no longer exist, and we only meet with parallel bands, from which issue very irregular ramifications which unite with the adjacent bands.

The hairs of the decapodous *Crustacea* are simple or barbed; they never have barbules. They are not a prolongation of the epidermal layer; they are always in communication with the interior of the shell by a canal which traverses in a straight line the thickness of the carapace, and which is one while empty and at another filled with a matter similar to that which exists in the interior of the hairs. They all have a central canal filled with a marrow analogous to that which is found in the hairs of the higher animals. They all grow from a rounded part, which has the greatest analogy with bulbs. These sorts of bulbs are always situated in the pigmental layer. The irregular bodies which cover certain *Crustacea*, and in particular *Pisa tetraodon*, are only hairs, the barbs of which are coherent.

The spines of the decapodous *Crustacea* appear to be continued in the epidermal layer, with which they have the greatest analogy in appearance and composition. We find in them a very considerable number of small canals analogous to those of the hairs, and which, like the last, traverse the whole shell to reach the spine.

With respect to the tubercles often found in the pigmental layer, and each of which has a small canal by means of which they communicate with the interior of the shell, we can only consider them as

organs analogous to the bulbs which are found at the base of the hairs.

I shall here only observe further, that my investigations seem to be in complete opposition to the theories which make the shell of the *Crustacea* analogous* to the scaly epidermis of serpents and lizards. I see no analogy between the shedding of the shell of the *Crustacea*,—which divests them of organs destined to give the body its form and volume, to serve as points of attachment to the locomotor muscles, to furnish the instruments of prehension and mastication; organs placed not only on the surface of the body, but often immersed in the midst of the soft parts, and in which we find an organization such as I have described,—and the periodical shedding observed in reptiles of a thin epidermis, without consistency, completely inorganized and incapable of fulfilling any of the uses to which the shell is destined.

My researches have convinced me of the vitality of the shell, at least in the first period of its existence; and in reference to this, I am fully of Cuvier's opinion, when he said, in his 'Anatomie Comparée,' "The envelope of the *Crustacea* is at first soft, sensible, and even furnished with vessels; but a quantity of calcareous molecules soon collect there, harden it, and obstruct the pores and vessels."

Such was also the decided opinion of Dugés†.—*Comptes Rendus*, Jan. 4, 1847.

THE TEA PLANT OF CHINA.

There are few subjects connected with the vegetable kingdom which have attracted such a large share of public notice as the tea-plant of China. Its cultivation on the Chinese hills, the particular species or variety which produces the black and green teas of commerce, and the method of preparing the leaves, have always been objects of peculiar interest. The jealousy of the Chinese government in former times prevented foreigners from visiting any of the districts where tea is cultivated; and the information derived from the Chinese merchants, even scanty as it was, was not to be depended upon. And hence we find our English authors contradicting each other; some asserting that the black and green teas are produced by the same variety, and that the difference in colour is the result of a different mode of preparation; while others say that the black teas are produced from the plant called by botanists *Thea Bohea*, and the green from *Thea viridis*, both of which we have had for many years in our gardens in England. During my travels in China since the last war, I have had frequent opportunities of inspecting some extensive tea districts in the black and green-tea countries of Canton, Fokien, and Chekiang, and the result of these observations is now laid be-

* The reader will see the need of the term *homologous*, signifying 'answerable part or namesake,' proposed by Professor Owen; as the shell of the Crustacea is 'analogous' to the scaly epidermis of serpents and lizards, inasmuch as it has a similar relation to the protection of the surface of the body.

† See Dr. Schmidt's important researches on this subject in Taylor's 'Scientific Memoirs,' Part XVII.

fore the reader. It will prove that even those who have had the best means of judging have been deceived, and that the greater part of the black and green teas which are brought yearly from China to Europe and America are obtained from the same species or variety, namely, from the *Thea viridis*. Dried specimens of this plant were prepared in the districts I have named by myself, and are now in the herbarium of the Horticultural Society of London, so that there can be no longer any doubt upon the subject. In various parts of the Canton province, where I had an opportunity of seeing tea cultivated, the species proved to be the *Thea Bohea*, or what is commonly called the black-tea plant. In the green-tea districts of the north—I allude more particularly to the province of Chekiang—I never met with a single plant of this species, which is so common in the fields and gardens near Canton. All the plants in the green-tea country near Ning-po, on the islands of the Chusan Archipelago, and in every part of the province which I had an opportunity of visiting, proved, without exception, to be the *Thea viridis*. Two hundred miles further to the north-west, in the province of Kiang-nan, and only a short distance from the tea hills in that quarter, I also found in gardens this same species of tea. Thus far my actual observation exactly verified the opinions I had formed on the subject before I left England, viz. that the black teas were prepared from the *Thea Bohea* and the green from *Thea viridis*. When I left the north, on my way to the city of Foo-chow-foo, on the river Min, in the province of Fokien, I had no doubt that I should find the tea hills there covered with the other species, *Thea Bohea*, from which we generally suppose the black teas are made; and this was the more likely to be the case as this species actually derives its specific name from the Bohee hills in this province. Great was my surprise to find all the plants on the tea hills near Foo-chow exactly the same as those in the green-tea districts of the north. Here were, then, green-tea plantations on the black-tea hills, and not a single plant of the *Thea Bohea* to be seen. Moreover, at the time of my visit, the natives were busily employed in the manufacture of black teas. Although the specific differences of the tea-plants were well-known to me, I was so much surprised, and I may add amused, at this discovery, that I procured a set of specimens for the herbarium, and also dug up a living plant, which I took northward to Chekiang. On comparing it with those which grow on the green-tea hills, no difference whatever was observed. It appears, therefore, that the black and green teas of the northern districts of China (those districts in which the greater part of the teas for the foreign markets are made) are both produced from the same variety, and that that variety is the *Thea viridis*, or what is commonly called the green-tea plant. On the other hand, those black and green teas which are manufactured in considerable quantities in the vicinity of Canton are obtained from the *Thea Bohea*, or black tea. * * *

In the green-tea districts of Chekiang near Ning-po, the first crop of leaves is generally gathered about the middle of April. This consists of the young leaf-buds just as they begin to unfold, and

forms a fine and delicate kind of young hyson, which is held in high estimation by the natives, and is generally sent about in small quantities as presents to their friends. It is a scarce and expensive article, and the picking of the leaves in such a young state does considerable injury to the tea-plantations. The summer rains, however, which fall copiously about this season, moisten the earth and air; and if the plants are young and vigorous, they soon push out fresh leaves. In a fortnight or three weeks from the time of the first picking, or about the beginning of May, the shrubs are again covered with fresh leaves, and are ready for the second gathering, which is, in fact, the most important of the season. The third and last gathering, which takes place as soon as new leaves are formed, produces a very inferior kind of tea, which, I believe, is rarely sent out of the district. The mode of gathering and preparing the leaves of the tea-plants is extremely simple. We have been so long accustomed to magnify and mystify everything relating to the Chinese, that in all their arts and manufactures we expect to find some peculiar and out-of-the-way practice, when the fact is, that many operations in China are more simple in their character than in most other parts of the world. To rightly understand the process of rolling and drying the leaves, which I am about to describe, it must be borne in mind that the grand object is to expel the moisture, and at the same time to retain as much as possible of the aromatic and other desirable secretions of the species. The system adopted to attain this end is as simple as it is efficacious. In the harvest seasons the natives are seen in little family groups on the side of every hill, when the weather is dry, engaged in gathering the tea-leaves. They do not seem so particular as I imagined they would have been in this operation, but strip the leaves off rapidly and promiscuously, and throw them all into round baskets made for the purpose out of split bamboo or rattan. In the beginning of May, when the principal gathering takes place, the young seed-vessels are about as large as peas. These are also stripped off and dried with the leaves; it is these seed-vessels which we often see in our tea, and which have some slight resemblance to young capers. When a sufficient quantity of leaves are gathered, they are carried home to the cottage or barn, where the operation of drying is performed.

This is minutely described, and the author continues:—

I have stated that the plants grown in the district of Chekiang produce green teas, but it must not be supposed that they are the green teas which are exported to England. The leaf has a much more natural colour, and has little or none of what we call the 'beautiful bloom' upon it, which is so much admired in Europe and America. There is now no doubt that all these 'blooming' green teas which are manufactured at Canton, are dyed with prussian blue and gypsum, to suit the taste of the foreign 'barbarians': indeed, the process may be seen any day, during the season, by those who will give themselves the trouble to seek after it. It is very likely that the same ingredients are also used in dyeing the northern green teas for the foreign market; of this, however, I am not quite certain. There is

a vegetable dye obtained from *Isatis indigotica* much used in the northern districts, and called *Tein-ching*; and it is not unlikely that it may be the substance which is employed. The Chinese never use these dyed teas themselves, and I certainly think their taste in this respect is more correct than ours. It is not to be supposed that the dye used can produce any very bad effects upon the consumer, for, had this been the case, it would have been discovered before now; but if entirely harmless or inert, its being so must be ascribed to the very small quantity which is employed in the manufacture.

In short, the black and green teas, which generally come to England from the northern provinces of China, are made from the same species; and the difference of colour, flavour, &c. is solely the result of the different modes of preparation.—*From Mr. Fortune's 'China.'*

Description of two new species of Shells. By WILLIAM CASE.

Helix annulata. Shell minute, much depressed—umbilicus showing all the volutions; aperture simple and somewhat oval; whorls four, banded by thin, sharp and parallel ribs, inclining slightly forward; intercostal space marked with waved lines, running parallel with the whorls; nearly transparent; diameter about one line.

This minute but beautiful shell was found by Captain B. A. Stanard, in the region about Lake Superior, and I have heard of its being observed in other places, but so far as I can learn, it is undescribed. It differs from any description of the *pulchella* I have yet met with, in having uniformly an *oval* aperture and *simple lip*. The *H. minuta* of Say, I believe never has the parallel ribs, and is supplied with a lip.

Planorbis multivolvis. Shell about five-eighths of an inch in diameter; whorls seven, about half of the last whorl overlapping the preceding one, sometimes the last whorl suddenly distorted and expanded for the last half of its length; right side concave, left side slightly acuminate and considerably carinate; throat campanulate; aperture opening towards the left, but projecting on both sides beyond the preceding whorl.

This shell also I obtained from Captain Stanard, who found it in the northern part of Michigan. It is very distinct from any *Planorbis* I have met with, or have been able to find any description of. I have named it from its strong characteristic—a greater number of whorls than usual in the genus.

Note.—The *Helix* here described approaches the *pulchella*, (*minuta* of Say,) a ribbed variety of which is called *H. costata*; yet it appears to be a distinct species. The *Planorbis* is most nearly allied to the *P. campanulatus.*—A. A. G.—*Silliman's American Journal*, Jan. 1847.

TRICHINA SPIRALIS.

Dr. Leidy stated, at a recent meeting of the Academy of Natural Sciences, Philadelphia, that he had lately detected the existence of an Entozoon in the superficial part of the extensor muscles of the thigh of a hog. The Entozoon is a minute, coiled worm, contained

in a cyst. The cysts are numerous, white, oval in shape, of a gritty nature, and between the thirtieth and fortieth of an inch in length.

The Entozoon he supposes to be the *Trichina spiralis*, heretofore considered as peculiar to the human species. He could perceive no distinction between it and the specimens of *T. spiralis* which he had met with in several human subjects in the dissecting-rooms, where it had also been observed by others, since the attention of the scientific public had been directed to it by Mr. Hilton and Professor Owen.

METEOROLOGICAL OBSERVATIONS FOR MARCH 1847.

Chiswick.—March 1.—3. Cloudy. 4. Fine: cloudy. 5, 6. Cloudy. 7. Slight showers: uniformly overcast: clear. 8. Small rain: cloudy. 9. Cloudy. 10. Hazy: severe frost at night. 11. Slight haze: cloudy: frosty. 12. Clear. 13. Cloudy. 14—18. Clear, with bright sun. 19. Clear: cloudy. 20, 21. Cloudy: clear. 22. Hazy. 23, 24. Cloudy. 25. Foggy: clear: cloudy. 26. Slight haze: fine. 27. Foggy: fine. 28. Uniformly overcast: rain. 29. Very clear: cloudy: frosty. 30. Clear: cloudy: clear and frosty. 31. Frosty: cloudy.

Mean temperature of the month	40°·14
Mean temperature of March 1846	43 ·43
Mean temperature of March for the last twenty years...	42 ·91
Average amount of rain in March	1·36 inch.

Boston.—March 1—5. Cloudy. 6. Fine. 7. Fine: rain early A.M.: rain P.M. 8. Cloudy. 9. Fine: snow A.M. and P.M. 10. Cloudy: hail and snow P.M. 11—13. Fine. 14. Cloudy. 15—18. Fine. 19. Fine: a luminous appearance of an extraordinary nature seen in the sky 9 P.M. 20, 21. Cloudy. 22. Fine. 23. Fine: rain P.M. 24, 25. Fine. 26, 27. Cloudy. 28. Cloudy: rain A.M. and P.M. 29. Fine: thick ice this morning: hail A.M.: rain P.M. 30. Fine: hail P.M. 31. Fine.

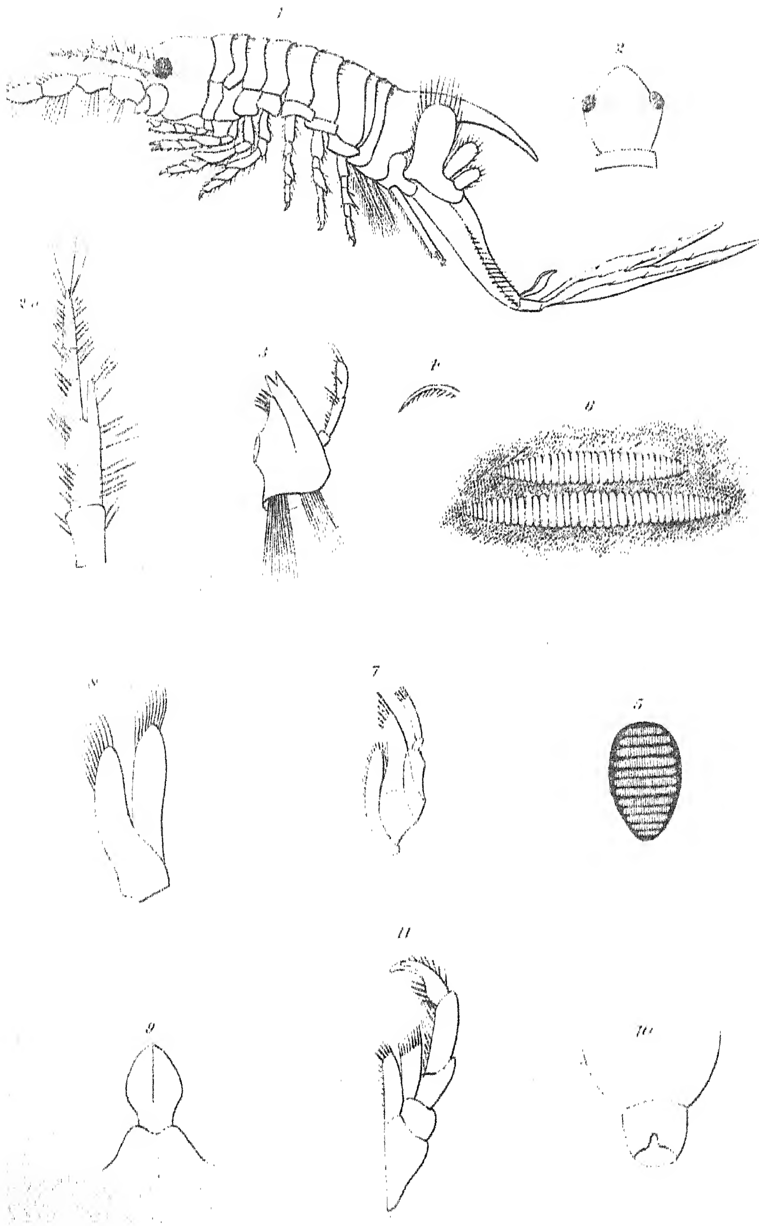
Sandwick Manse, Orkney.—March 1. Cloudy: clear. 2. Bright: clear. 3. Showers: clear. 4, 5. Cloudy. 6. Showers: cloudy. 7. Damp: cloudy. 8. Showers: snow-showers. 9. Snow-showers. 10. Snow: cloudy. 11. Showers: sleet-showers. 12. Showers. 13. Cloudy: showers. 14. Bright: cloudy. 15, 16. Cloudy. 17, 18. Bright: cloudy. 19, 20. Bright: clear: aurora. 21. Bright: clear. 22. Bright: large halo. 23. Damp: cloudy. 24. Damp. 25. Cloudy. 26. Damp: cloudy. 27. Cloudy. 28. Hail-showers: sleet-showers. 29. Shower: clear. 30, 31. Snow-shower.

Applegarth Manse, Dumfries-shire.—March 1. Thaw: slight rain. 2. Slight frost: very mild. 3. No frost: gray day. 4. Frost, slight. 5. No frost: clear and fine. 6. No frost: dull and cloudy. 7. No frost. 8. Slight frost: clear. 9. Frost, hard. 10. Frost, hard: sprinkling of snow. 11. Frost: sprinkling of rain P.M. 12. Frost again. 13. Fair and moderate weather. 14. Fair, but threatening: change. 15. Fair still, but cloudy. 16. Fair: rain P.M. 17. Rain all day. 18. Very fine: fair. 19. Very fine. 20. Rain: cleared P.M. 21. Heavy showers. 22. Fine: a few drops of rain. 23. Rain A.M.: thunder P.M. 24. Frosty: fine. 25. Slight frost. 26. Rain. 27. Very fine: rain A.M. 28. Clear and cold: slight snow. 29. Fair: cold: slight frost. 30. Fair: slight frost. 31. Slight snow: hail: frost.

Mean temperature of the month	42°·5
Mean temperature of March 1846	42 ·2
Mean temperature of March for 25 years	39 ·1
Mean rain in March for 20 years	2·35 inches.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse,* Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. March.	Max.	Min.		9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9½ a.m.	8½ p.m.								
1.	30·384	30·275	30·05	30·35	30·40	30·52	30·56	42	24	37	45	36	40	38	e.	calm	e.	nw.				
○ 2.	30·508	30·417	30·16	30·49	30·50	30·57	30·60	45	37	37	45	35	43	42	ne.	calm	ne.	nnw.				·05
3.	30·491	30·488	30·19	30·51	30·48	30·59	30·57	43	24	41	45½	37½	43½	41	ne.	calm	ne.	wnw.				·07
4.	30·474	30·375	30·12	30·45	30·40	30·56	30·55	43	37	37·5	45	33	43	42½	ne.	calm	ne.	nnw.				·04
5.	30·265	30·250	29·93	30·36	30·33	30·53	30·50	42	34	43	48	37½	43½	40	ne.	n.	ne.	n.				
6.	30·170	30·022	29·85	30·23	30·12	30·36	30·30	41	34	43	46½	35½	45	42½	ne.	calm	nne.	n.	·01			
7.	30·113	29·968	29·69	30·09	30·13	30·25	30·22	45	32	42	49½	36½	46	44	ne.	ne.	n.	nw.	·01	·15		
8.	30·113	30·029	29·74	30·08	29·98	30·12	30·08	49	35	42	50	35	41	32½	n.	calm	n.	n.		·14	0·00	·10
9.	30·027	29·986	29·65	29·97	29·92	30·06	30·05	42	22	37	43	34	33	30	n.	nw.	n.	w.				·09
☾ 10.	30·127	29·931	29·66	29·90	30·10	30·16	30·08	40	27	31	40	28	30	30	ne.	calm	ne.	wsw.				·07
11.	30·218	30·140	29·95	30·00	29·75	29·62	29·83	36	26	31	41½	21½	39	36	w.	calm	w.	n.	·05			·23
12.	30·234	30·041	29·72	30·00	30·02	30·05	29·91	46	25	37	45	30½	38	41	n.	calm	nw.	w.	·01			·12
13.	30·315	30·027	29·84	30·00	30·08	29·99	29·97	47	25	40	49	37	40½	45	w.	w.	w.	w.				·10
14.	30·345	30·290	29·94	30·05	29·95	29·93	29·71	52	24	42·5	46½	40	47	45	sw.	calm	e.	s.				·04
15.	30·206	30·005	29·76	29·83	29·63	29·63	29·48	58	34	37	57½	39½	48	49	s.	sw.	s.–se.	s.			0·05	
● 16.	29·904	29·795	29·53	29·53	29·40	29·45	29·37	59	42	45	60	38	49	45	s.	sw.	se.	ssw.				
17.	29·832	29·794	29·44	29·50	29·60	29·53	29·64	61	26	48	52½	46½	47½	49	s.	sw.	se.	s.				
18.	29·848	29·825	29·49	29·65	29·63	29·74	29·66	61	27	46	61	43	50	47	s.	calm	ssw.	se.				
19.	29·729	29·489	29·38	29·50	29·30	29·60	29·46	59	37	47	60½	44	49½	43½	s.	calm	se.	se.				
20.	29·542	29·493	29·10	29·17	29·22	29·27	29·34	57	41	50	54	45	45½	43	sw.	s.	se.	sse.				
21.	29·659	29·524	29·16	29·25	29·50	29·43	29·48	51	26	48	52	44	47	43	sw.	calm	se.–s.	se.				
22.	29·843	29·715	29·42	29·70	29·70	29·77	29·85	58	34	42·5	57	37½	49	42	e.	calm	ssw.	e.				
☽ 23.	29·810	29·729	29·42	29·58	29·50	29·81	29·79	53	30	48	52	43	43	43	s.	calm	sse.	e.			0·52	
24.	29·919	29·771	29·38	29·62	29·79	29·84	29·96	52	23	46	51	33	45	43	s.	calm	nne.	ese.		·21		
25.	30·011	29·990	29·36	29·88	29·88	30·04	30·06	61	39	45	52	34½	42½	41½	s.	calm	e.	se.				
26.	30·017	29·969	29·64	29·85	29·83	30·07	30·04	64	31	43	49	40	41½	41½	se.	se.	e.	ese.				
27.	29·996	29·808	29·60	29·84	29·74	30·00	29·91	63	39	47	56½	43½	43½	42	se.	calm	ne.	nw.				
28.	29·604	29·483	29·27	29·60	29·64	29·84	29·77	52	30	48	47½	41½	37	40	s.	calm	ne.	n.	·32			·15
29.	29·760	29·679	29·37	29·67	29·63	29·84	29·82	49	26	38	49	31	40	36	nw.	nw.	nnw.	n.		·37		·31
30.	29·712	29·621	29·34	29·62	29·50	29·71	29·68	50	20	38	45½	31	38½	37	w.	nw.	nnw.	n.	·01	·03	0·70	·07
○ 31.	29·563	29·446	29·20	29·45	29·30	29·53	29·37	45	32	36	45	30	34	33½	ne.	nw.	nnw.	n.		·04		·12
Mean.	30·023	29·915	29·00	29·868	29·837	29·948	29·922	50·51	29·77	41·7	49·7	36·8	42·67	40·91					0·41	0·94	1·27	1·56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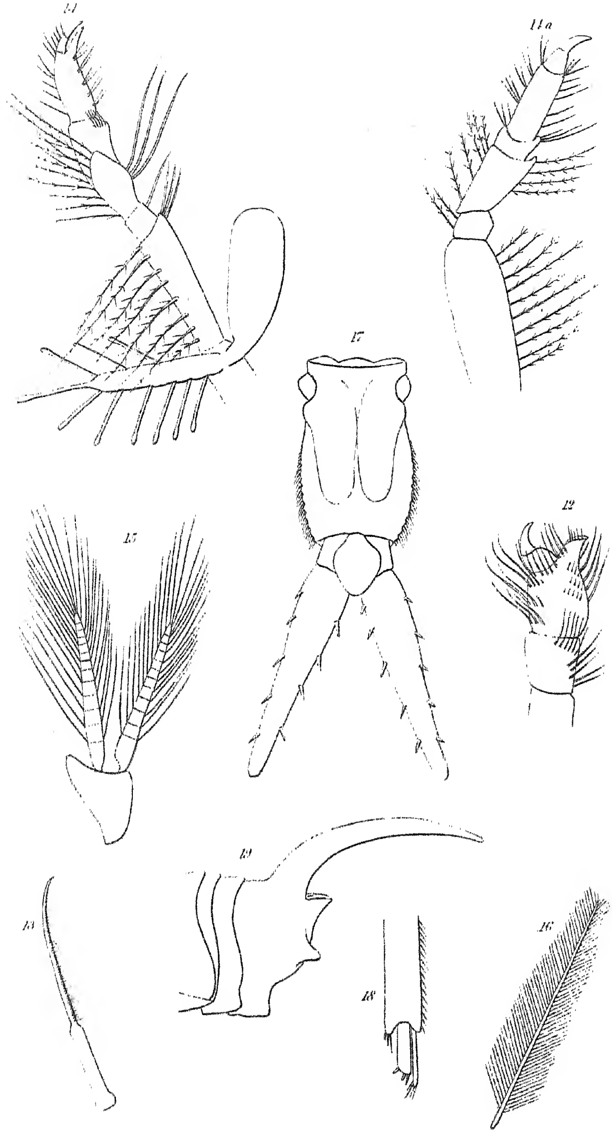

J. D. C. Sowerby, sc.

THE ANNALS

AND

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XXXVIII.—*Biological Contributions.* By George J. Allman, M.B., F.R.C.S.I., M.R.I.A., Professor of Botany in Trinity College, Dublin, late Demonstrator of Anatomy and Conservator of the Anatomical Museum, T. C. D.

[With two Plates.]

[Continued from vol. xvii. p. 419.]

No. II. *On* Chelura terebrans, *Philippi, an Amphipodous Crustacean destructive to submarine timber-works* *.

In January last, my friend Professor Oldham placed in my hands for examination a small crustacean discovered in great numbers by M. B. Mullins, Esq., C.E., in perforations formed in the timber-piles of the jetty in the harbour of Kingstown near Dublin.

The little animal was totally unknown to me, and believing it to belong to even a generic form hitherto unrecorded, I lost no time in submitting it to a careful examination, and having had at my disposal abundance of living specimens, I drew up a full description of the supposed new genus, and made drawings of its details with a view to immediate publication.

My memoir on the Crustacean was thus completed and ready for the printer, when Mr. Thompson of Belfast directed my attention to a description of a new genus of Amphipods given by Philippi in Wiegmann's 'Archiv,' 1839, and translated into the fourth volume of the 'Annals of Natural History.'

In my search for some published record of the timber-destroying Crustacean, I had overlooked Philippi's memoir, and yet here was to be found a description of the very animal to which I had devoted many hours' careful examination. It is true that neither Philippi's description nor drawings will apply in every particular to the Irish specimens, but yet I would feel rather disposed to consider the discrepancy as the result of certain slight errors in the memoir of the excellent naturalist who has the honour of the

* Read before the Royal Irish Academy, April 12, 1847.

discovery, and which it is often almost impossible to avoid, than to view it as pointing towards any real distinction.

Notwithstanding this anticipation, I have yet deemed it advisable to publish my original paper, making of course the name which I had given to the Crustacean, yield to that which its discoverer had previously imposed upon it. To this determination I have come, not only from the fact of my researches having been conducted quite independently of any knowledge of what had been previously done in the matter, but also because, from having had abundance of living specimens at my disposal, my details are considerably fuller than those of Philippi, while they do not, as has just been said, correspond in all points with the description given by this naturalist.

Specimens from the Kingstown locality have been for some years in the collection of Mr. Robert Ball, who must be viewed as the original discoverer of the crustacean as an inhabitant of the British seas, though it is in a paper read by Mr. Mullins in January last before the Institute of Civil Engineers in Ireland, with the view of eliciting suggestions for preserving timber from the attacks of this and other destroyers, that is to be found the first record of the animal as an addition to our fauna.

In the year 1834 Mr. Thompson noticed the occurrence in the same place of *Limnoria terebrans**, and this animal may still be detected proceeding along with the subject of the present paper in its ravages, but quite outdone by the latter in the work of destruction.

The characters of the genus may be comprised in the following enumeration :—

CHELURA, Phil.

GEN. CHAR. *Body* not compressed. *Head* distinct. Superior *antennæ* shorter and more slender than the inferior, and consisting of a peduncular portion which supports two unequally developed rami; inferior *antennæ* large, not divisible into a distinct peduncle and ramus. *Mandibles* strong, palpigerous, furnished with a molar tubercle with transverse ridges. First pair of *maxillæ* strong, pyramidal, palpigerous; second pair lamelliform. *Maxillary feet* large, bearing a palp-like stem, and united at their origin so as to constitute a great opercular lip covering all the other organs of the mouth. *Thorax*† com-

* Thompson (Wm.) on *Teredo navalis* and *Limnoria terebrans* in Edinb. New Phil. Journ. January 1834.

† It is deemed advisable throughout the present paper to adopt the generally received terminology, though the beautiful researches of Erichson (Entomographia) have altogether disproved its correctness, the thorax of carcinological writers generally being according to this philosophic naturalist composed almost entirely of segments really belonging to the abdomen.

posed of seven distinct segments with the epimeræ distinct and moderately developed. First two pairs of *thoracic feet* didactyle, five remaining pairs terminated by a small unopposable claw. First three segments of *abdomen* each bearing a pair of biramous natatory feet; remainder of abdomen consisting of one very large trunk supporting anteriorly a pair of large foliaceous lobed appendages and a pair of cylindrical false feet, and terminated posteriorly by two lamellar leaping organs and an intermediate leaf-like lobe*.

Species unica, *C. terebrans*†, Phil. Pl. XIII. fig. 1.

Hab. In timber taken from the sea at Trieste, *Philippi*. In excavations formed in the timber-piles of the jetty in Kingstown Harbour near Dublin, *M. B. Mullins, Esq., and R. Ball, Esq.*

The largest specimens of *C. terebrans* measure about half an inch in length, including the caudal appendages and antennæ. The head is large, and presents when viewed from above a tolerably regular pentagon with one angle directed forwards between the eyes (fig. 2). These last are borne upon the two latero-anterior angles, which are prominent, and almost suggest the first sketch of the ocular peduncles of the podophthalmic crustacea.

There are two pairs of antennæ; the superior (fig. 1 and fig. 2[a]) originate at the level of the eyes and on their internal side. They consist of a peduncular portion which is composed of three hirsute articulations, the last of which supports two rami of very unequal development‡, one being as long as the peduncle and composed of six hirsute articulations, the other consisting of a single slender articulation terminated by two or three rudimental ones with a few long hairs and not reaching beyond the first joint of the longer ramus. The last two articulations of the longer ramus are very minute. The inferior antennæ (fig. 1) are considerably larger than the superior; they originate just below

* Philippi gives no detached summary of the generic characters; the above, which were drawn out from an examination of the Irish specimens, are therefore retained.

† It has been already mentioned that a slight discrepancy exists between Philippi's description and that here given. This however has been supposed to be referable to a source different from a real distinction between the animals described. It is yet possible however that the Adriatic and Irish species may not be the same. The discrepancy alluded to will be chiefly found in the form of the superior antennæ and of the terminal portion of the last three pairs of feet. Though it may therefore perhaps be deemed advisable to retain provisionally for the Irish animal the specific name "*destructor*" applied to it in my original paper, subject to rejection or confirmation according as an actual comparison of specimens may decide, I have nevertheless in the present memoir preferred considering the Irish as identical with the Adriatic species.

‡ This condition of the superior antennæ is not described by Philippi.

the eyes, and are composed of six articulations, which, except the second, which is the smallest, do not differ from one another much in size; these antennæ thus present no distinct division into peduncle and ramus; the last four articulations are clothed with long hair, especially on the inferior surface; the last is flattened, and assumes the condition of a fringed oval lamina. The oral appendages consist of a pair of mandibles and two pairs of maxillæ, together with an upper and lower lip, the whole being covered in by a pair of large maxillary feet. The mandibles (fig. 3) are very strong, bidentate at the anterior and inner angle, and furnished along their inner edge with long curved spines beset with minute spinulæ (figs. 3 & 4). Between the spines and the base of the mandibles is an oval elevated surface marked with transverse ridges which are again crossed at right angles by delicate striæ (figs. 3, 5, 6). This singular eminence must constitute a very efficient molar surface, and would seem evidently in connection with the peculiar habits of the animal, though it has its representative in other Crustaceans of the same order. The mandibles support upon their external side a three-jointed setigerous palp, and are furnished with powerful adductor and abductor muscles.

The first pair of maxillæ (fig. 7) consist of strong, somewhat pyramidal organs bearing stiff setæ at the apex, furnished on the outer side with a two-jointed palp, and carrying at the base an oval fringed lamina analogous to a flagellum.

The maxillæ of the second pair (fig. 8) consist of an elongated lamina supporting a somewhat similar one upon its external edge. This last must be viewed as a flattened single-jointed palp, or else as the terminal joint of a two-jointed stem, the internal lamina being formed by the basal articulation; both laminæ are terminated by long setæ.

The upper and lower lips (figs. 9 & 10) are fleshy, somewhat conical organs, bounding the buccal cavity anteriorly and posteriorly.

The maxillary feet are united at their origin, and thus constitute a sort of great opercular sternal lip which lies over and conceals all the other oral organs. Each (fig. 11) consists of a large basal joint supporting a well-developed palp-like stem which is composed of four joints and a terminal incurved claw. The basal joint moreover as well as the first joint of the stem support each, internally, a large plate, thus completing this great opercular lip towards the mesial line of the mouth.

The thorax consists of seven distinct segments each with a pair of legs. Of these the two anterior pairs are didactyle and directed forwards over the mouth. The penultimate and antepenultimate joints of the first pair (fig. 12) are clothed with setæ

whose structure is peculiar. These setæ are bulbous at their origin, then present for some distance a cylindrical stem, but soon become suddenly attenuated, and from this point to the extremity are beautifully pectinated on one side (fig. 13). They are for the most part arranged in linear groups of from three to five. The setæ which immediately surround the base of the last joint are of the ordinary structure.

The second pair of feet (fig. 14) resembles the first in all essential points; it is however without the pectinated setæ, and its antepenultimate joint, which is narrower than that of the first, supports near its distal extremity a row of small curved spines constituting a kind of comb-like organ. The five pairs of feet which succeed to these (fig. 1 & fig. 14[a]) are all nearly similar to each other, and consist of six joints, of which the terminal one is in the form of a short claw, but does not by opposition to a produced portion of the penultimate joint constitute, as in the first two pairs of feet, a didactyle prehensile organ. The third and fourth pairs resemble the first two in being directed forwards, the last three pairs point backwards. In none of the thoracic legs does the first joint present the shield-like form so frequent among the *Gammaridæ*.

The thoracic legs are copiously beset with long hairs, for the most part plumose; a flattened membranous branchial vesicle is borne at the base of each (fig. 14), and in the females there is also found in the same place another appendage in the form of an oblong membrane (fig. 14) set round its edges with blunt spines, and probably destined for the protection of the eggs.

In the abdomen five distinct segments may be demonstrated. The first two resemble those of the thorax, but are narrower, and not furnished with distinct epimeræ. The third is large, also without distinct epimeræ, and is produced posteriorly by a long curved spine which points towards the tail, and has a small tubercle or rudimental spine at each side. These three segments carry each a pair of biramous natatory feet, each foot (fig. 15) consisting of a basal lamina supporting two long, flat, transversely striated rami which are copiously furnished on the edges with long, beautifully plumose setæ (fig. 16). These natatory feet are kept in a constant state of rapid vibration backwards and forwards both while the little animal is swimming and while it is holding on by its true feet, and they would seem, by the extensive currents which they produce in the surrounding fluid, to be subservient to respiration as well as to locomotion.

To the three segments just described there succeeds a very large one (figs. 1, 17), equal in length to about twice that of the preceding three together. It is of a somewhat oblong figure compressed horizontally, with a slightly prominent keel at each

side. It supports three pairs of *heteromorphous* appendages. Those of the first pair consist each of a long basal stem terminated by two small, one-jointed rami (figs. 1, 18), and articulated upon the inferior edge of a small vertical plate, which is placed at each side of the anterior end of the segment. The second pair is articulated upon the same plate, at a point nearly vertically over the origin of the first. It is a large lamellar organ (fig. 1) fringed with hair, and having two fringed leaflets articulated on its edge; in its habitual position it is thrown up vertically upon the back, with its surfaces directed, one inwards and the other outwards. The appendages of the third pair constitute a sort of tail by which the body is prolonged backwards; they are borne upon the posterior extremity of the segment, and consist each of a very large leaf-like lamina supported on a short basal joint* (figs. 1, 17); the margins of the lamina are serrated, each serration bearing a minute but strong spine.

The terminal segment of the abdomen assumes the form of a small leaf-like lobe (figs. 1, 17) placed between the origins of the two last-mentioned appendages.

The true import of the great abdominal trunk, with its appendages, may now for a few moments arrest our attention.

The probability of its being made up of three distinct elements would at once be suggested by the fact of its bearing three pairs of appendages, as well as by the circumstance that such view would establish the normal number of abdominal rings; but then the peculiar position of its two anterior pairs of appendages, one being placed vertically over the other, as well as their arising from a common intermediate plate, would present itself as a difficulty to this mode of viewing the subject. A careful examination however will get rid of the difficulty, and enable us to reconcile the apparent anomaly with the fact, that this single trunk is really made up of three confluent segments, each bearing its own pair of appendages. If the under surface of this part of the abdomen be examined, it will be found marked near its anterior extremity by two transverse grooves, terminated at the sides by the lateral plates already mentioned, and plainly indicating the existence of three originally distinct rings, of which the posterior alone becomes greatly developed. The lateral plates must then be viewed as the very unequally developed episternal pieces of the first two of these rings, so consolidated as to leave no trace of their original distinctness, while the second episternal piece being developed in a forward direction, and pass-

* It is these basal joints of the two caudal appendages which Philippi seems to have mistaken for a fifth abdominal segment, with the anus in a fissure on the back.

ing above the first, must bring the appendages of the second ring nearly vertically over those of the first; and the episternal pieces of the first ring remaining rudimental, the whole assumes the appearance of a single plate supporting two appendages, one on its upper, and the other on its lower edge. The third ring becomes greatly developed, and carries its very large appendages at its posterior end.

The six pairs of abdominal appendages, though so very heteromorphous, may yet be easily reduced to a common type. Let us assume as a point of comparison the natatory isomorphous legs of the first three abdominal segments, in which we have the stem and palp of a completely developed limb represented by a basal inarticulate lamina supporting on its distal edge two long setose lamellar rami with transverse striæ indicating the traces of articulation. In the fourth pair of abdominal members the basal lamina becomes long and cylindrical, and the rami are reduced to two minute inarticulate appendages; in the fifth pair the basal portion becomes again lamellar, disproportionately developed, and produced on one side into a large fringed lobe, while the two terminal rami assume the appearance of small oval fringed plates, pushed towards the other side by the large lateral lobe; finally, in the sixth pair the basal portion preserves somewhat of its normal condition while one of the rami disappears, and the other acquires an enormous development, constituting one of the most striking features in the little animal's physiognomy; in the seventh abdominal segment the appendages have completely vanished.

To the internal anatomy of *Chelura* I have not yet given sufficient attention to enable me to introduce into the present paper facts of much importance in this part of the inquiry. It may however be stated, that a large dorsal vessel with transverse branches may be seen vigorously pulsating through the entire length of the thorax, and that the stomach is supported by a corneous framework and lined with a minutely spinulose epithelium.

Chelura terebrans is an active little animal, swimming on its back and employing its thoracic legs to adhere to the timber which it has selected for its ravages. The large lamellar appendages placed near the anterior end of the great abdominal trunk do not appear to be employed in swimming, they are kept thrown upwards on each side of the spinous process of the third abdominal segment, and seem in no way subservient to locomotion; they are not confined to any particular sex, and it is difficult to assign to them any office unless it be that of keeping the excavations formed by the Amphipod free from the detritus of the timber, and from other extraneous bodies which might interfere with respiration.

When removed from the water and placed upon a resisting surface, the little crustacean bends the abdomen under the thorax, brings the terminal appendages between the antennæ, and then suddenly resuming its straight condition, springs to a considerable distance.

The habits of *Chelura terebrans* are truly xylophagous, and it excavates the timber not merely for the purpose of concealment, but with the object of employing it as food, which is apparent from the fact that the alimentary canal may be found on dissection filled with minutely comminuted ligneous matter. It will freely attack a piece of timber placed with it in a glass of sea-water, so that its habits may be studied in confinement. Timber which has been subjected to the ravages of *Chelura* presents a somewhat different appearance from that which has been attacked by *Limnoria terebrans*. In the latter we find narrow cylindrical burrows running deep into the interior, while the excavations of *Chelura* are considerably larger and more oblique in their direction, so that the surface of the timber thus undermined by these destructive animals is rapidly washed away by the action of the sea, and the excavations are exposed in the greater part of their extent, the wood appearing ploughed up, so to speak, rather than burrowed into. Upon the whole, *Chelura* would seem to be a still more destructive creature than even *Limnoria*.

General Considerations.

Milne Edwards* divides the Amphipoda into two great families, of which *Gammarus* and *Hyperia* may be taken as the respective types, assuming as the essential characters of his division, the different conditions presented by the maxillary feet, these differences being found to be for the most part in connection with certain other peculiarities of structure as well as of habits.

Of the two families thus formed, that of the *Gammaridæ* (famille des *Crevettines*, Edw.) will include the subject of the present notice, provided we implicitly yield to the characters drawn from the condition of the maxillary feet. The division however adopted by the great French carcinologist, though adapted to the state of our knowledge of the *Amphipoda* previously to the discovery of the present animal, and separating the then known forms into two sufficiently natural groups, cannot we think be now undeviatingly adhered to, as would seem evident from an attentive consideration of the characters just given of *Chelura terebrans*. This crustacean has its maxillary feet entirely referable to the form of these organs in *Gammarus* and its allies, and

* Hist. Nat. des Crust. t. iii.

yet we believe the rest of its organization as well as its habits will separate it as far from the family of the *Gammaridæ*, as this family is separated from that of the *Hyperidæ* (famille des *Hyperines*, Edw.).

We believe that in the order *Amphipoda* an important systematic character available in the formation of our higher groups will be found in the condition of the last four rings of the abdomen with their appendages. In the entire order of *Amphipoda*, the abdomen (using this word in its ordinary acceptation among carcinologists) is divided into two very distinct regions, an anterior and a posterior. The former is composed invariably of three distinct rings, and supports three pairs of isomorphous natatory feet; the posterior portion also bears three pairs of appendages, but these are never formed like the feet of the anterior region*.

In the two families of *Gammaridæ* and *Hyperidæ*, constituting the entire order of *Amphipoda* in the system of M. Edwards, the appendages of the fourth and fifth abdominal rings (the first two rings of the posterior region) are similar to each other, and consist each of a long cylindrical peduncle terminated by two pieces whose form varies within narrow limits in different genera, and the rings which support these appendages are distinct from one another.

In *Chelura* however it is very different; we are here at once struck with the great size of the posterior region of the abdomen, and we find that the first, second and third ring of this region are consolidated into one great trunk which bears three pairs of *heteromorphous* appendages.

From these two very different conditions of the abdomen, therefore, we may obtain characters available in the formation of our primary division of the order. In a zoological point of view I believe we may consider such characters as ranking higher than those which are derived from the conformation of the maxillary feet, a principle indeed which is already acknowledged in the establishment of the order *Læmodipoda*, in which the maxillary feet as well as the other oral appendages are in every respect like those of the *Gammaridæ*, and in which the rudimental condition of the abdomen is almost the sole character from which these Crustacea have been established as a distinct order†.

* The anterior and posterior regions of the abdomen here alluded to must not be confounded with those to which Erichson, in his more philosophic views of the import of the parts among the Crustacea, has applied the same phraseology; the anterior region of this author consisting of a large portion of the so-called *thorax*, while his posterior region is made up of those segments to which the term *abdomen* is exclusively given by the generality of writers, and to which, in order to avoid misconception, we have thought it better to restrict it here.

† The universal absence of mandibular palps in the *Læmodipoda* has been

Availing ourselves therefore of the characters derived from these considerations, the families of the Amphipodous Crustacea may be analytically arranged as follows :—

			Family.
AMPHIPODA.	Fourth and fifth abdominal segments confluent. Abdominal appendages of the fourth and fifth pair very different in form (heteromorphous).		CHELURIDÆ.
	Fourth and fifth abdominal segments distinct. Abdominal appendages of the fourth and fifth pair nearly similar in form (isomorphous).	Mouth concealed by the maxillary feet.	GAMMARIDÆ.
		Mouth not concealed by the maxillary feet.	HYPERIDÆ.

EXPLANATION OF PLATES XIII. AND XIV.

PLATE XIII.

Fig. 1. *Chelura terebrans* magnified.
Fig. 2. The *head* deprived of the antennæ and viewed from above.
Fig. 2ª. One of the *superior antennæ*.
Fig. 3. One of the *mandibles*.
Fig. 4. A *spine* from the inner edge of the mandible.
Fig. 5. Molar surface of the *mandibular tubercle* much magnified.
Fig. 6. Portion of the same still more highly magnified.
Fig. 7. One of the *first pair of maxillæ*.
Fig. 8. One of the *maxillæ of the second pair*.
Fig. 9. *Upper lip* viewed on its oral aspect.
Fig. 10. *Lower lip* viewed on its oral aspect.
Fig. 11. *Maxillary foot* of the left side.

PLATE XIV.

Fig. 12. Terminal portion of one of the *first pair of thoracic feet*.
Fig. 13. One of the *pectinated bristles* of its penultimate joint.
Fig. 14. One of the *second pair of thoracic feet*.
Fig. 14ª. *Thoracic foot* of the *seventh pair*.
Fig. 15. An *abdominal foot* from one of *the first three pairs*.
Fig. 16. One of its *plumose setæ*.
Fig. 17. *Posterior portion of abdomen* deprived of its first and second pairs of appendages and viewed from above.
Fig. 18. One of the first pair of appendages from the great abdominal trunk.
Fig. 19. First three abdominal rings.

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disproved, and the absence of distinct epimeræ is but a slight degradation from the condition presented to us in the gressorial *Gammaridæ*. The *Læmodipoda* are indeed a group in every way referable to the Amphipodous type, and there is much reason to believe that they should never have been separated as a distinct order. See Kroyer in the 'Isis' for 1846, Heft ii.

XXXIX.—*Ornithological Notes.* By John Blackwall, F.L.S.

[Continued from vol. xv. p. 171.]

The White Owl, *Strix flammea.*

Does the white owl hoot or does it not? is a question which has engaged the attention of ornithologists in consequence of a doubt expressed on the subject by the Rev. Gilbert White, in his 'Natural History of Selborne,' Letter XV., addressed to the Honourable Daines Barrington.

Having enjoyed peculiarly favourable opportunities of deciding this question, I am prepared to answer it in the negative.

For a long series of years I resided at Crumpsall Hall, near Manchester, situated in the township from which it takes its name; and during the greater part of that period the premises were constantly frequented by this species of *Strix*, but no hooting ever occurred there, and I may add that the tawny owl, *Syrnium aluco*, was unknown in the township. This last remark applies equally to the adjoining township of Broughton, in which a pair of white owls brought up their young annually in an out-building attached to Broughton Hall, the residence of the late Rev. John Clowes, under whose protecting care they enjoyed a secure asylum; the call termed hooting, however, was never heard in that locality either by Mr. Clowes, by myself, or by any persons familiar with the neighbourhood as far as I had an opportunity of ascertaining the fact. I am decidedly of opinion therefore that the white owl does not hoot.

It would seem that the tawny owl ceases to hoot when in captivity; at all events, I have kept individuals of this species for several years confined to a piece of ground surrounded with walls, including a dark shed in which they roosted, without once hearing this their well-known call.

The singularity of the incident I am about to narrate will serve as a sufficient apology for its introduction here.

Very early one fine morning in June 1831 my slumbers were interrupted by the sound produced by something beating against one of the windows of my sleeping-room at Crumpsall Hall, and on looking in the direction from which the noise proceeded, I was surprised to see a white owl clinging by its talons to the window-frame and striking against the glass with the extremities of its expanded wings; at last it flew away, having persevered in this extraordinary occupation for more than a minute. Previously to quitting my room I opened the window at which the bird had appeared so desirous to effect an entrance, and on joining the family at the breakfast-table mentioned what had occurred, when my brother, Mr. Thomas Blackwall, stated that he had been

disturbed in a similar manner. After the morning repast was finished I proceeded to Manchester, and did not return home till the evening, when I was told by one of the domestics that the housemaid had got a fine white owl for me. On inquiring how it had been procured, I was informed that the young woman on entering the dressing-room connected with my sleeping-apartment, the door of which was open, felt something alight on her left shoulder, and on turning her head in order to ascertain what it was, perceived the large dark eyes of the owl directed full upon her face: though amazed and somewhat startled, yet she had the presence of mind to close the door, and with the assistance of a fellow-servant succeeded in securing the intruder, which, there can be little doubt, was the identical bird that had in vain attempted to obtain admission early in the morning. At first I was inclined to think that it must be a partially domesticated pet which had escaped from confinement, but the very fine condition of its plumage, and the circumstance of its declining to take any of the diversified articles of food which were presented to it, convinced me that such was not the case; after remaining in my possession nearly two days and two nights without partaking of any nutriment whatever, it was suffered to escape lest it should die of starvation. In support of the conclusion here arrived at, I may remark that a white owl captured by the footman in the preceding winter, on its perch among the branches of a young beech which retained its withered foliage, during a violent storm, likewise refused to take any food; whereas, young birds of this species when removed from the nest and brought up by hand feed freely and soon become familiar.

The Common Dipper, *Cinclus aquaticus.*

The mountain-streams of North Wales are much frequented by dippers, which occasionally construct their bulky nests among aquatic plants growing upon the face of rocks over which a sheet of water is precipitated. Under such circumstances, the birds on quitting their domiciles and returning to them pass through the falling torrent without any apparent difficulty, and, as they generally pursue the course of the stream in their flight, sometimes come in contact with the rod or line of the angler who is exerting his skill to allure the trout from its retreat with the artificial fly.

I have reason to believe that the dipper occasionally preys upon small fish, for in the months of October and November 1844, several individuals were observed to descend into the river Conway and speedily to emerge with a light-coloured object about two inches long in their bill, having every appearance of the young of some species of migratory *Salmonidæ*, with which they flew to

a stone or mass of rock in the vicinity of the stream, and after violently striking the prize against it several times in rapid succession, swallowed it entire.

The agreeable song of this species may frequently be heard early in the year, even during severe frost.

The Rook, *Corvus frugilegus*.

The rook introduced to notice in the 'Annals and Magazine of Natural History,' vol. xv. pp. 169, 170, as the subject of an experiment made for the purpose of ascertaining whether the nudity at the base of the bill and the anterior part of the head in this species is referable to a mechanical or to a physiological cause, was accidentally killed on the 20th of June 1846. It lived long enough, however, thoroughly to establish the fact, that after the feathers are once shed from those parts in the act of moulting they are not renewed, as the denudation became rather more extensive and complete after the bird had moulted a second time in the summer of 1845, and continued unchanged to the day of its death, affording a convincing proof that this conspicuous feature in the adult rook, which strikingly affects its physiognomical expression, must be regarded as a specific character.

The Cuckoo, *Cuculus canorus*.

Several intelligent ornithologists have denied or doubted the capability of young cuckoos to eject the progeny of their foster-parents from the nest until they are a week or ten days old, and have acquired the use of their eyes. This incredulity can only be accounted for on the supposition that such observers have failed carefully to investigate the early œconomy of this species, which I shall proceed to show not only serves to establish the fact called in question, but likewise renders evident the unreasonableness of hastily rejecting phænomena which are extraordinary or anomalous as unworthy of belief, and of relying too exclusively on analogical reasoning in natural history.

On the 30th of June 1823 I took the nest of a meadow pipit, *Anthus pratensis*, containing a young cuckoo, which was disengaged from the egg on the 28th of the same month, and supporting it firmly near the side of my bed on the evening of the day on which it was procured, very early in the morning of the 1st of July, when all was still, I carefully introduced into it eggs of different kinds in the first instance, and afterwards young birds previously selected for the purpose, and had the satisfaction of contemplating at leisure the entire process of their ejection, so minutely and accurately described by Dr. Jenner*. These asto-

* See the Memoirs of the Literary and Philosophical Society of Manchester, Second Series, vol. iv. p. 462.

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nishing feats, it will be perceived, were accomplished by the nestling cuckoo when it was only three days old, and, consequently, before it had the use of its eyes; it died soon after, and to me, who witnessed its exploits, it is an object of much interest, being preserved in spirit of wine to the present hour.

The curious fact, first announced in the 'Memoirs of the Literary and Philosophical Society of Manchester,' Second Series, vol. iv. pp. 455, 456, that the cuckoo frequently watches birds construct the nests in which it deposits its eggs, is not, it seems, peculiar to that species; according to Mr. Audubon, a similar instinct is manifested under like circumstances by the cow-pen bird, *Icterus pecoris,* whose œconomy resembles that of the cuckoo in other remarkable particulars. (Ornithological Biography, vol. i. pp. 495, 496.)

To the recorded instances of young cuckoos having been preserved alive through the winter, I am enabled, by the kindness of Mrs. Warner of Crumpsall Green, to add another. This lady procured a nestling cuckoo on the 12th of July 1842, and by skilful management and constant attention succeeded in keeping it in excellent health till July 1843, when it died of inflammation caused by the negligence of the servant who had the care of it, Mrs. Warner being absent at the time on a visit to her sister, who resided at a distance. In the second week of August the young bird began to exhibit symptoms of restlessness, which increased to such a degree that it was found requisite to keep it in darkness, lest the violent efforts it made to effect an escape from captivity should occasion its destruction. This extreme agitation, which continued, with short intervals of repose, through the day and night, began to subside towards the end of the month, and ceased altogether about the middle of September, having been limited to the night for a short period antecedent to the last date. The act of moulting, which commenced in February, proceeded with extreme slowness and was never completed, though the bird was provided with nourishing food in abundance, and the temperature of the room in which it was kept was not suffered to fall below 50° Fahrenheit.

A person named Thomas Holt brought to Crumpsall Hall on the 1st of July 1826 a young cuckoo which he had taken about an hour before out of the nest of a meadow pipit, and at my request he undertook to keep and treat it according to such instructions as from time to time I should communicate to him. This nestling, under the prescribed system of management, increased rapidly in growth and vigour, and as the principal object I had in view was to ascertain whether it would become torpid or not on the approach of winter, the cage occupied by it was placed in a room without fire. In the ensuing November sharp

frosts were of frequent occurrence; the maximum temperature of the last week in that month, indicated by a pair of Rutherford's horizontal self-registering thermometers exposed to the open air in a shady situation, was 46°·5, the minimum 22°, and the mean 36°, as recorded in my meteorological journal; but in January 1827 the cold became intense; the temperature descended to zero on the night of the 4th, and the mean for the month was so low as 34°·18.

Notwithstanding the extreme severity of the season, the young bird did not manifest the slightest symptom of torpidity, and on the 12th of January I exhibited it at a meeting of the Literary and Philosophical Society of Manchester, at which time it was moulting, and in as good health apparently as birds usually are when undergoing that process, a minute to that effect being entered in the journal of the proceedings of the Society by my friend Mr. Peter Clare, who then officiated as secretary. On the 18th of the succeeding February this young cuckoo died very suddenly, an event occasioned in all probability by exposure to severe cold, for a Six's self-registering thermometer fixed in its cage several days before indicated that the temperature had descended to 31°; and though the bird had previously resisted the effects of a much lower degree of temperature, yet it had not then made such progress in moulting, and was therefore better protected, being more completely covered with feathers. I may remark, that in the year 1826, adult cuckoos disappeared from the neighbourhood of Manchester in the first week of July, and that young birds of the same species were not observed there after the termination of August.

Admitting the difficulty of proving a negative, still I am inclined to think that the experiment detailed above, when taken in conjunction with others to be adduced hereafter, goes far to establish the fact, that birds have not any physiological tendency to torpidity.

In advocating this view of the subject, I am aware that I stand opposed to the high authority of Cuvier, who, in treating upon the sand-martin, *Hirundo riparia*, in the first edition of the 'Règne Animal,' tome i. p. 374, asserts, with reference to its supposed torpor, that "il paraît constant qu'elle s'engourdit pendant l'hiver, et même qu'elle passe cet état au fond de l'eau des marais;" and the same opinion is reiterated by Humboldt in one of his published works; but as I have not an opportunity of referring to them at present, I cannot state in which. Both these celebrated authors, however, have omitted to communicate the particulars which led them to this conclusion, and the bare assertion even of persons the most distinguished in the annals of science cannot be received as equivalent to direct evidence; more-

over, all the British *Hirundinidæ* moult in the interval which elapses between the times of their disappearance and reappearance in this country. Such also is the case with the cuckoo and some other species of periodical summer-birds: how utterly irreconcilable this plain fact is with the hypothesis of their passing that interval in a state of torpidity needs scarcely to be insisted upon; indeed it is absolutely inconceivable that birds in a lethargy so profound as that in which the animal functions seem to be suspended should undergo a change of plumage, when Mrs. Warner's cuckoo, enjoying all the advantages of exuberant animation, high temperature and stimulating nutriment, failed to do so.

I now revert to the experiments. Three young house martins, *Hirundines urbicæ*, were taken from a nest in the chapelry of Blakeley, near Manchester, in September 1827, and were kept in a room without fire. From the 21st of the November following to the 27th inclusive there was a continuance of inclement weather, the maximum temperature for the period being 47°·5, the minimum 19°, and the mean 33°·39, yet not the least disposition to become torpid was apparent in the young martins, though they did not long survive the test to which they had been subjected; indeed, for periodical birds to suffer severely, and even to perish from cold and hunger during their sojourn in this country, is no uncommon case; but a lowering temperature and a decreasing supply of food, when they pass certain limits, are the very conditions which should induce torpidity in them were they liable to be so affected, and which actually do produce such a result in animals known to be endowed with this constitutional peculiarity.

I myself have repeatedly seen large numbers of swallows, *Hirundines rusticæ*, reduced to the necessity of alighting in fields for the purpose of obtaining some of the insects which a low temperature had constrained to seek refuge among the herbage, and so greatly were they enfeebled as almost to suffer themselves to be taken with the hand.

Severe and long-continued frosts, especially when accompanied with snow, often prove very fatal to the redwing, *Turdus iliacus*, and under such circumstances, I have occasionally found individuals of this species dead or in a dying state.

Numerous instances of a similar kind might be selected from works on natural history, but one will suffice. I quote from 'A Catalogue of the Norfolk and Suffolk Birds, with Remarks, by the Rev. R. Sheppard and the Rev. W. Whitear,' published in the 'Transactions of the Linnæan Society,' vol. xv.:—"The following extraordinary circumstance in the natural history of the swallow, which occurred at Christ Church, Ipswich, (the residence of the Rev. Mr. Fonnereau,) very forcibly illustrates the

unusual coldness and backwardness of the season:—'On the mornings of the 5th and 6th of June 1816, the gardeners could have taken up hundreds of these birds in their hands: they were collected in knots, and sat on the grass in parcels of thirty and forty. This, there is reason to believe, was owing both to cold and hunger.'—*Suffolk Chronicle, June* 15, 1816. The same summer many house martins were found dead on the ground in Norfolk, and others were so weak that the cats sprang upon them and caught them as they flew near the ground. A pair of these birds, which had completed a nest under the eaves of our house, were both found dead in it before any eggs were laid. From the above circumstances, birds of this kind were unusually scarce throughout the summer."

The effects produced by variations in temperature upon the dormouse, *Myoxus avellanarius*, and other animals whose liability to become torpid is unquestionable, claim attention in the next place.

Having obtained five healthy dormice, I endeavoured at various periods in the year 1824 to render them torpid by artificial means. Two of them were placed in a tall cylindrical glass jar, with a supply of flax and cotton for the construction of a dormitory; and when they were familiar with their new residence, it was weighted to keep it steady, and put into a tub containing cold water, which rose within a few inches of its top. The temperature of the water was further reduced by causing to be speedily dissolved in it finely pulverized muriate of ammonia and nitrate of potash mixed in equal quantities, the degree of cold produced in the glass jar being ascertained by means of a small thermometer included within it. Experiments of this kind were soon perceived to be too uncertain in their results to effect the purpose for which they were instituted; for though the dormice sometimes became perfectly lethargic, yet it frequently happened that no such consequence followed, the rapid fluctuations in the temperature of the water, and the motion unavoidably attendant upon the process, combining to stimulate the animals and prevent torpidity.

Disappointed in this attempt, I resolved to rely on the natural temperature of the atmosphere solely; and on suspending a cage containing two of the dormice in the open air from a window having a north aspect, whenever the thermometer was unusually low for the season, I had the satisfaction to find, that by this simple expedient they were rendered completely torpid at intervals in every month of the year 1824; the other three dormice continuing quite alert on those occasions if subjected to the influence of a high degree of temperature. After constructing a comfortable bed of flax and cotton on being exposed to a cold

atmosphere, the two dormice in the cage invariably placed themselves in their usual posture of repose, when sleep ensued, which gradually lapsed into torpidity, accompanied with all the customary symptoms, such as decreasing circulation, respiration, temperature and irritability. While in a state of transition the respiration became intermittent, and, with the circulation, ultimately ceased to be apparent. The temperature of the skin slowly descended to that of the atmosphere or nearly so, and the nervous irritability diminished so greatly that loud and sudden sounds, whether grave or acute, produced no sensible effect; punctures also with sharp instruments, and slight electric shocks and sparks given by means of a Leyden jar and an electrophorus, merely occasioned a degree of muscular contraction so small as scarcely to be discerned; but the repeated application of external stimuli causing bodily pain, exposure to a current of hot or cold air, or to a high degree of temperature alone, at all times prevented the animals from becoming torpid, and when torpid speedily revived them.

The hedgehog, *Erinaceus europæus*, long-eared bat, *Plecotus auritus*, common wasp, *Vespa vulgaris*, flesh fly, *Musca vomitoria*, house fly, *Musca domestica*, peacock butterfly, *Vanessa io*, and tortoise-shell butterfly, *Vanessa urticæ*, when found in winter in a torpid state, I have frequently restored to animation by subjecting them to a high temperature, perfect torpidity having been again induced on submitting them to the requisite degree of cold.

In the year 1829 I captured several specimens of the large aquatic beetle, *Dyticus marginalis*, for the purpose of making some observations and experiments relative to the structure and use of the cup-shaped suckers, with which the males have the tarsi of the first and second pairs of legs provided on the under side, and putting them into an earthenware vessel containing water, I supplied them during several weeks with raw flesh, which they devoured greedily. The month of December in the same year terminated in severe frost; the maximum temperature of the last week was 37°, the minimum 16°·5, and the mean 28°·75; consequently the water in the earthenware vessel was frozen into a solid mass of ice, and it remained in that state for some days, yet, on being gradually thawed, the beetles resumed, and long continued to exercise their customary functions.

From the foregoing experiments it appears that birds are not liable to be rendered torpid on being exposed to the same agency which quickly induces torpor in various animals known to possess a constitutional proneness to that state of lethargy. It is obvious therefore that they must differ physiologically from those animals; and I am disposed to think that the legitimate inference to be deduced from the facts is, as I have already stated,

that birds have no tendency whatever to torpidity, which seems to result from diminished nervous irritability, occasioned by a low degree of temperature, more or less directly affecting numerous important vital functions, as circulation, respiration, and necessarily the evolution of animal heat; also digestion, secretion, assimilation, absorption and excretion.

That the periodical birds which visit this country in autumn are not rendered torpid by cold will be readily acknowledged, as they are known to quit the north of Europe on the approach of winter for more genial climates in lower latitudes; and it has been shown that even in Britain the redwing frequently falls a victim to severe and protracted frosts. Why then should any reluctance be felt to admit that the periodical birds, whose appearance in spring is attended with so many pleasing associations, retire from this kingdom on the return of the cold season to more southern countries, where a suitable temperature and an ample store of food are to be found? I have endeavoured to prove by experiment that they do not become torpid; and I may add, that a premium of five pounds a head, publicly offered for birds in a state of perfect torpidity, when I resided at Crumpsall Hall, failed to produce a single individual, though, for a fifth part of the sum, I know that I might have been abundantly supplied with torpid bats and hedgehogs.

Thus it is seen that experiment, observation and analogy are all in favour of the conclusion at which I have arrived, namely, that there is no physiological tendency whatever in birds to become torpid.

XL.—*Descriptions of new British Coleoptera, with additional Notes.* By James Hardy, Esq.

Rhyzophagus cyaneipennis, *Hardy.*

Niger, nitidus, convexus, capite crebre thoraceque minus dense punctatis, illo triangulari, hoc subquadrato-globoso; elytris cyaneis minus profunde punctato-striatis; pedibus antennisque rufis, his apicibus nigris. Long. corp. lin. $1\frac{1}{2}$.

Shining: head black, short, much narrower in front, thickly and finely punctured: eyes rather prominent: antennæ ferruginous, as long as the thorax; club small, black, piceous at the apex: thorax black, subquadrate, globose, convex, punctured less thickly but more coarsely than the head: scutellum black: elytra convex, cyaneous, with a very narrow brown line along the margins and the suture, slightly depressed behind the scutellum, finely punctate-striate; striæ rather shallow, deepest towards the base; punctures confused at the apex; there are a few confused interstitial

punctures round the scutellum; the base of the elytra is about the breadth of the middle of the thorax: legs with the femora strongly constricted before the apex; the tibiæ attenuated at the base, subclavate at the apex; the tarsi paler, ferruginous, with the last joint spatulate, elongate and attenuated.

I took a single specimen under the bark of *Alnus glutinosa* on the margin of the river Derwent, near Gibside, in June.

Obs. The projecting eyes, black and rather small club of the antennæ, rounded thorax, cyaneous elytra, and the convexity of the insect, are its obvious features.

APHODIUS SUBALPINUS, *Hardy.*

Niger, nitidus, clypeo emarginato, punctato rugoso, tuberculis tribus, medio subcornuto; maris thorace convexo rotundato-ampliato disco punctis subtilibus minus frequenter dispositis, feminæ subquadrato angustiore punctis mediis frequenter obsitis; elytris nigris humeris apicibusque rufis, vel totis rufis, punctato-striatis, interstitiis punctulatis; corpore subtus fulvo-pubescente; pedibus nigris, tarsis rufescentibus. Long. corp. lin. 3—3½.

Male. Black, glossy, robust: clypeus emarginate, punctate-rugose in front and in a less degree behind; the margin is elevated; the surface is unequal; there is a large central tubercle on the crown, and on each side a minute and almost obsolete one, being an elevated portion of a ridge that runs behind the central tubercle, and bends obliquely to join the margin before it reaches the hinder angle, which is distinct, rounded, and finely ciliated: base of the antennæ rufous; club clothed with a changeable fulvous or slaty pubescence: thorax convex, approaching to globose, widened at the middle, considerably broader in front than the clypeus, and behind than the base of the elytra, divided by a nearly obsolete middle line which is most discernible at the base, finely and somewhat distantly punctured on the disc, but becoming more thickly and distinctly punctured on the sides, a number of larger punctures being intermixed with those of smaller size; the lateral margins are finely ciliated with fulvous hairs arising from the breast: mesosternum with a large, deep, lozenge-shaped, and distinctly punctured depression: scutellum punctured at the base, smooth at the apex: elytra convex and black; the apex and sometimes the base and the shoulders, and even the whole elytra are red; they are punctate-striate, narrowed at the base, compressed before the middle, expanded towards the apex, and about as broad as the thorax; the interstices are flattish, minutely and distantly punctured; the punctures increase in size and number at the apex: body clothed beneath with fulvous pubescence, more particularly on the prothorax, the sides of the breast and the apex of the abdomen: legs black; femora,

especially the anterior, fringed with fulvous pubescence; tibiæ finely ciliated, their tips sometimes piceous; tarsi rufescent.

Var. β. Aph. ericetorum, MSS. olim. *Female.* Smaller and differently shaped, being broader behind and gradually narrower to the apex of the head; posterior angles and tubercles of the clypeus less distinct; thorax less convex; body beneath more thinly pubescent: thorax subquadrate, widest and as broad as the elytra behind, somewhat parallel on the sides, narrower but wider than the clypeus in front; it is thickly and distinctly punctured throughout with a mixture of large and small punctures which are rather more crowded on the sides, the former predominate.

Var. β. The size of the female, and having the thorax of the male punctured nearly like that of the other sex. Rachills, Dumfries-shire, *Rev. W. Little*; on the heaths of Berwickshire, *J. H. Var. β.* Prestwick Car, Northumberland, *J. H.* May to July.

The Rev. W. Little has recently informed me that he has had this species in his possession for several years, and having sent specimens thereof to Mr. Stephens, he returned them with the name "*Lapponicus.*" Gyllenhal has an *A. Lapponum,* but not being able to ascertain what its characters are, or what is the origin of Mr. Stephens's name, I have, with Mr. Little's concurrence, adhered to that by which I had designated my specimens in consideration of the upland tract of country which they inhabited.

Obs. As the sexual distinctions in *Aphodius* have been little attended to, I may state the process by which I became convinced of the propriety of uniting these apparently distinct insects. I had often been unable to account for *A. terrestris* having a thorax more dilated and globose in some specimens than in others, and bringing both these states into a comparison with my *A. subalpinus* and *A. ericetorum,* I found that the globose thorax was combined with a more sparingly punctured disc and a strong development of the frontal tubercles, but that a crowd of punctures was distinctive of a narrow thorax, and that along with this modification the tubercles of the clypeus underwent a diminution in size. Referring to *A. Fossor,* in which the sexes were known, I found that the punctured thorax and less evident tuberculation of the clypeus was a female character, while the male along with its dilated thorax had, as was the case with the species under review, a decided superiority in size. I had no longer any doubt that my *A. ericetorum* was a variety of *A. subalpinus.* Applying the principle thus obtained to other species, it appears to hold pretty generally among species in which the puncturing of the thorax is not particularly dense. *A. erraticus,* which belongs to Mulsant's genus *Colobopterus,* is in the latter condition. As an additional instance of the former, *A. sordidus* may be cited. In the male of this species the thorax is dilated, the disc is nearly

destitute of punctures, and the sides carry only a few; in the female the thorax is subquadrate, the punctures are more thickly disposed upon the sides and likewise scattered over the disc; the male is distinctly tuberculated, while the clypeus in the female is almost smooth. It may also be remarked, with reference to *A. terrestris* and *A. melanopus*, that the larger the specimen the more obsolete becomes the puncturing, and the number of punctures and their size augment in proportion as it approaches nearer to the size of the female. Thus also we have, in the specimens of *A. subalpinus* from Prestwick Car, which are of the female size, a combination of the male and female characters, a result that may have been produced by their becoming dwarfed towards the limit of their geographical range. In *A. melanopus* I find that the character of the female thorax goes to oppose a portion of the specific character as drawn from the male, Mr. Stephens having described that species as having the thorax rather finely and sparingly punctured. Being in possession of a series of this species, I shall venture to point out its characters with a slight detail, to compare with that author's description.

Aphodius melanopus, *Kirby*.

Steph. Ill. Mand. iii. 198. *Ib.* Manual, No. 1292.

Niger, nitidus, clypeo antice rugoso, postice læviore punctis minutis, tuberculis tribus, duobus lateralibus antice linea curva conjunctis, tuberculis in feminis minutis vel totis obsoletis, thorace maris subrotundato tenue punctulato, feminæ subquadrato punctis frequentioribus majoribusque, utriusque linea media longitudinali leviter depressa antice evanescente, "elytris piceo-nigris apice pallidiore, punctato-striatis," interstitiis parum elevatis, punctis interstitialibus perminutis, corpore subtus parce fulvo-pubescente, pedibus nigris, tarsis dilutis. *Long. corp.* lin. 2—2½.

My specimens were taken at Prestwick Car in April, in company with Mr. T. J. Bold of Newcastle.

Aphodius uliginosus, *Hardy*.

Niger, nitidus, clypeo tuberculis tribus instructo, lateralibus minutis, in femina omnino obsoletis, thorace sparsim punctato, angulis posterioribus rufis, elytris punctato-striatis, piceis, humeris apicibusque rufis, pedibus nigris vel piceis. *Long. corp.* lin. 1¾—2.

Black, shining: clypeus narrower in front and slightly emarginate; hinder angles rather distinct, finely and somewhat distantly punctured, bearing in front a very indistinct bent ridge before which the surface is slightly depressed; there are three tubercles on the crown, but excepting the middle one they are very faint, and all three are obsolete in the female; edge of the clypeus usually red: antennæ rufous at base; club black or piceous with ashy reflections: maxillary palpi piceous: thorax as broad as

the base of the elytra, subquadrate, narrower in front, and having a slight rise on the middle of each side; the front angles are slightly projecting; the hind angles are rufous; the anterior and lateral margins are dispersedly punctured with a mixture of coarse and fine punctures, the former are narrowly, the latter indefinitely rufous or piceous; the base is slightly and obliquely truncate on each side: breast behind the anterior legs obscure, with a very indistinct opake middle line: mesosternum broad, punctured, and with a shallow depression: scutellum depressed and punctured at the base, smooth at the tip: elytra piceous, shining and polished, nearly parallel; shoulders somewhat prominent, of a bright red, and the entire base is also sometimes reddish; the tip has two red dots or fasciæ, or is indefinitely red; it is punctate-striate, the striæ are somewhat deep, the interstices are apparently smooth, but beneath a lens they are indistinctly subrugulose: body beneath very sparingly clothed with fulvous pubescence: femora and coxæ black; femora fringed with a slight pubescence; tibiæ piceous; posterior tibiæ scarcely dilated with subequal teeth; tarsi ferruginous, sometimes entirely piceous.

In marshy places on the Berwickshire heaths, and at Prestwick Car, Northumberland, *J. H.*; Tenby, South Wales, *T. V. Wollaston, Esq.* May to July.

I first took this species in Berwickshire in 1845, and recorded it in the 'Berwickshire Naturalists' Club's Proceedings' as *A. granum*, deeming that in the tuberculated specimens I had discovered the male of that species. I again found it at Prestwick Car in the spring of 1846, and Mr. Wollaston having about the same period taken a fine series of it in Pembrokeshire, kindly pointed out my mistake.

Obs. From *A. granum*, to which it bears a close resemblance, this species is primarily distinguished by the tubercles with which the male is beset; and the red humeral and apical spots or fasciæ furnish a constant character in all the specimens of *A. uliginosus* that I have examined. *A. granum* is generally larger, has a broader and more distinctly punctured clypeus, the thorax also is broader and rounder as seen from beneath; the elytra are relatively shorter and more tapering at the tips; the posterior tibiæ are broader at the tips and more deeply dentate, and the spines of the tibiæ are more distinct than in *A. uliginosus*. The under surface of *A. granum* is almost glabrous, and on that part of its breast which is behind the base of the anterior legs, there is a very distinct minutely punctured and shining longitudinal line, but this part in *A. uliginosus* is quite opake. The mesosternum in *A. granum* is rather narrow, and the central depression is more lengthened, deeper, and less distinctly punctured than in *A. uliginosus*.

XLI.—*On a new genus of Labyrinthi-bronchial Fish from Quellimane.* By Dr. W. Peters*.

[With a Plate.]

Among those fishes which live in the marshes of Quellimane, some are common to this part of Africa and the Nile, as the electrical shad-fish, *Malapterurus electricus*, *Clarias anguillaris* and *Chromis niloticus*; others belong also to both the western and eastern parts of Africa, as *Protopterus anguillaris* (*Lepidosiren annectens*); others are peculiar to Mozambique, as *Ctenopoma multispinis*, Peters, of the family of Labyrinthi-bronchial fishes, *Tribranchus anguillaris*, Peters, from the Muraenoid family (having only three gills), *Cyprinodon orthonotus*, Peters, of the family of Cyprinodonta, and a small new species of *Barbus*.

In Zambesia, the fauna of which I am acquainted with as far as Tette, we find, besides these, other Nile forms, as *Mormyrus*, *Varicorhinus*, *Labeo*, *Hydrocyon*, *Alestes*, *Distichodus*, *Heterobranchus*, *Bagrus*, *Synodontis*, some species of which are identical with those from the Nile, some of which are peculiar; also a new genus of *Characinæ*, which I shall describe in a future communication upon the fishes of Zambesia. That species of saw-fish, *Pristis Perotelli*, which lives in rivers only, is the only one which is common to Zambesia and Senegal.

The Labyrinthi-bronchial fishes, which are distinguished by the organs existing in the gill-cavity for respiration on land, are for the most part peculiar to Southern and Eastern Asia; *Spirobranchus* is the only form which has been hitherto known to occur in Africa; this belongs to the Cape.

The new genus of the family of Labyrinthi-bronchial fish possesses the following characters:—

Ctenopoma, Peters.

Operculum furnished with two semilunar segments and three pectiniform toothed folds; the two uppermost of these folds belong to the operculum, the lower one to the interoperculum and suboperculum. Preoperculum smooth. A great number of teeth on the vomer, and a band of the same on the gums on each side. Jaws furnished with thin, pointed and curved teeth, the first row of which is longer than the others. A single long dorsal fin with numerous prickly rays. Anal fin also furnished with numerous prickles. Body and operculum covered with scales which are posteriorly incised in a pectiniform manner. Pharyngeal teeth short and pointed. The lateral lines are interrupted. Gill-rays six. A well-developed accessory gill-organ situated above

* Translated from Müller's Archiv, 1846, part iv.

the latter, consisting on each side of an internal, larger, auriform labyrinthic gill, and an external, small, almost biscuit-shaped one; on the gill-arches there is moreover a discoid, shortly pedunculated piece of cartilage, but which is situated apart from the cavity of the above organ. A simple swimming-bladder. Stomach sacciform, and the simply coiled intestine has at its commencement a single rudimentary cæcum.

Ctenopoma multispinis, Peters. Pl. XI. fig. 3.

Form of the body extended; anal fin more than half as long as the dorsal fin, both furnished with elongated soft rays which form an acute posterior angle to these fins. Foramina exist in the infraorbital bones, as also laterally below the inferior maxilla. Two larger scales above and at the base of the pectoral fin. B. 6; D. 17, 9; V. 1, 5; A. 10, 9; P. 14; C. 14—15. Colour dark green above, becoming yellowish below. The body is covered with dark spots in two-thirds of its breadth, as are also the dorsal and caudal fins. Length 3 inches.

EXPLANATION OF PLATE XI.

Fig. 3. Animal of the natural size.
Fig. 4. *a*, Interior large labyrinthic gill; *b*, exterior small labyrinthic gill; *c*, discoid petiolated accessory organ.

XLII.—*Descriptions of new or imperfectly described Lepidopterous Insects.* By Edward Doubleday, Esq., F.L.S., Assistant in the Zoological Department of the British Museum, &c.

[Continued from p. 176.]

Fam. PIERIDÆ.

Genus Euterpe.

Eut. Dysoni. Alis omnibus supra nigris: *maris* fascia lata transversa alba: *feminæ* basi alba: marginibus externis albo maculatis; subtus nigro, brunneo, alboque variegatis; posticarum basi coccinea. Exp. alar. 2¼ unc. vel 57 mill.
Hab. Venezuela.

Anterior wings elongate, trigonate, somewhat truncate at the apex, the outer margin sinuate, dentate. Above, in the male, black, with a transverse white band, commencing near the costa beyond the cell, macular at its origin, widening towards the inner margin, dentate externally; between this band and the outer margin is a series of four or five whitish dots; cilia fuscous. Posterior wings with the anterior margin deeply emarginate near the base, the outer margin sinuate, dentate, the tooth in which

the second median nervule terminates being elongate: pearly white, slightly tinged with yellow and sprinkled with black scales near the base; the outer margin broadly black, marked in the sinuses with white. Cilia fuscous, spotted with white.

Below, the anterior wings have the cell fuscous, darkest externally; the fuscous colour extending beyond the cell; the outer margin fuscous, with a series of white dots corresponding to those of the upper surface, and the apex varied with brown, white and yellow, the whole of the other parts of the wing pearly white. Posterior wings pale brown, the costa at the base and a spot at the origin of the costal and subcostal nervures crimson; a macular band commences on the costa at the base and terminates on the inner margin slightly below the middle, describing about two-thirds of a circle; this band is composed of numerous, irregular white spots, divided by the nervures, each spot is marked by a yellow vitta and bounded internally by an irregular or cuneiform black spot and externally by a waved black striga; the spot above the costal nervure is divided by a small black patch. between this band and the margin is a broken white band distinctly indicated on the inner and outer angle, nearly obsolete in the middle of its course: between the nervules a series of fuscous clouds more or less divided by a central yellow line.

Head and antennæ fuscous above, paler below.

Thorax and base of abdomen clothed with long ashy hairs.

Abdomen ashy white.

The female differs in having the basal half of the anterior wings entirely white except a powdering of fuscous at the base and along the costa; the outer margin black, the black extending into the cell, beyond which is a short macular band divided into four parts by the nervules, and beyond this a submarginal series of white dots as in the male.

In the collection of the British Museum, &c.

I have named this beautiful species after its discoverer, Mr. D. Dyson, who has for the past year been indefatigably exploring the entomology of Venezuela. The female has a striking resemblance above to *Papilio Eudochus*, but the black border is much wider.

Eut. Teutila. Alis omnibus supra fuscis, fascia communi, media, maculari, punctisque submarginalibus albis: subtus anticis fascia media, maculari alba; punctis vittisque albis, aurantiacisque: posticis nigro, aurantiaco, alboque variegatis. Exp. alar. $2\frac{1}{4}$ unc. vel 56 mill.

Hab. Mexico.

Above, all the wings fuscous, slightly irrorated at the base with whitish scales, crossed by a narrow whitish band, commencing in the cell of the anterior wings a short distance from the

disco-cellular nervule, and crossing the posterior wings about the middle of the cell; broadest on the anterior wings, slightly tinted with buff on the abdominal margin; divided by the nervures which are fuscous. Beyond this band, close to the costa of the anterior wings, are two whitish dots, the upper elongate, the lower nearly round; separated only by the subcostal nervule. Near the margin is a series of dots between the nervules, composed of whitish scales not very closely placed; the dots nearest the apex of the anterior wings most distinct. Cilia fuscous, spotted with white.

Below, all the wings are fuscous: the anterior have the markings as above but more distinct, the spots towards the apex are tinged with yellow, and between the nervules near the apex are three or four delicate orange vittæ, becoming white where they touch the margin. Costa at the base whitish. The posterior wings have the space between the costal nervure and the costa white, tinged with orange near the base; at the base of the wings itself is a white dot bordered internally with a small tuft of crimson hairs. Before the middle of the wing is a band corresponding in position with that of the upper surface, composed of six orange spots more or less margined with white, the outer elongate, the second subtriangular, the third subquadrate, connected anteriorly with an orange vitta, the others smaller, more or less rounded, all resting on a black cloud. Between this band and the base are five orange spots near the inner margin and a single one on the costa. At the extremity of the cell is an orange vitta divided by the disco-cellular nervule, and between the cell and the outer margin a series of sagittate spots, orange internally, white externally, and on the margin itself between the nervules a series of similarly coloured vittæ.

Head, thorax and abdomen black, tinged with gray, shoulder slightly marked with orange.

In the collection of the British Museum.

Eut. Toca. Alis omnibus supra nigris, fascia media communi, maculari, serieque punctorum submarginali albis: subtus anticis vittis tribus baseos, fascia media alteraque submarginali macularibus albis, margine ipso albo flavoque maculato; posticis pallide stramineis, flavo, nigroque variegata. Exp. alar. $1\frac{3}{4}$ unc. vel 45 mill.

Hab. Bolivia.

Above, all the wings black, with a common transverse band arising on the costa and traversing the wings to the abdominal margin; macular and narrow at its origin, gradually widening to the inner margin of the anterior wings, not macular and still

wider on the posterior, but suddenly narrowed just within the median nervule. Between this band and the margin a series of rounded white spots, least distinct on the posterior wings. Cilia of the anterior wings fuscous, dotted near the apex with white, cilia of the posterior white with black dots.

Below, the anterior wings have the median band nearly as above, but the part nearest the costa is tinged with yellow; the spot in the cell is larger, the submarginal spots are larger and form a macular band, the upper ones being yellow; the outer margin is marked between the nervules with short vittæ, those near the apex yellow, the hinder ones white. The base with a whitish vitta along the costa and two in the cell.

Posterior wings very pale straw-yellow; the precostal nervule bordered with black, a black spot pupilled with yellow between the base of the costal and subcostal nervures, a black patch near the abdominal margin, at the base marked with six yellow spots, the two inner ones extended to the margin; a series of cuneiform yellow spots across the wing beyond the middle, bordered internally with black, preceded by five yellow vittæ, of which the third extends nearly the whole length of the cell; a small round yellow dot in the black at the end of the cell, and a series of yellow wedge-shaped spots bordered by a deeply zigzag black line on the outer margin.

Head black, the vertex yellow, palpi yellow, with long black hairs. Antennæ annulated with white. Thorax black, with a yellow spot at the shoulders, clothed above with silvery gray hairs, below with pale yellow. Legs black, varied with gray. Abdomen black above, with a few gray scales and hairs, below whitish.

In the collection of the British Museum, &c.

Eut. Colla. Alis anticis supra nigro-fuscis, fascia transversa communi, maculari, sulphurea, serieque submarginali punctorum sulphureorum: subtus fuscis, fascia transversa, maculis submarginalibus, vittisque marginalibus sulphureis, nebulis cinereis. Exp. alar. $2\frac{1}{4}$ unc. vel 57 mill.

Hab. Bolivia.

Above, all the wings fuscous black, crossed on the anterior beyond the cell by a macular band, composed of rather elongate sulphur-coloured spots larger towards the inner margin, this band continued across the posterior wings before the middle, divided by the nervures. In the cell of the anterior wings is a small sulphur-coloured spot, and near the margin of both wings a series of round dots of the same colour between the nervules. The margin of the posterior wings has three or four small sulphur-coloured dots.

Below, the colour is rather paler, the macular band more marked on the anterior wings, less so on the posterior; the spots of the submarginal series are lunulate on the anterior wings, the upper ones margined with pale cinereous, those of the posterior margined by a dark cloud within and a pale cloud externally: the external margin of the anterior wings with a series of slender vittæ between the nervules, the posterior with a series of wedge-shaped spots in the same position: base of both wings with two or three yellow vittæ, those of the posterior with a crimson spot.

Head, thorax and abdomen black, the thorax below spotted with yellow.

In the collection of the British Museum.

Eut. Pinava. Alis omnibus supra fuscis, fasciis duabus communibus macularibus ochraceis, serieque marginali punctorum ochraceorum; posticis purpurascenti-cinereis, fasciis duabus pallidis, maculis aliquot nigris flavisque. Exp. alar. $1\frac{3}{4}$ unc. vel 47 mill.
Hab. Bolivia.

Above, all the wings fuscous, traversed beyond the cell of the anterior by a macular band, narrow at the costa, enlarging towards the inner margin, composed of rather quadrate spots of an ochrey colour; continued across the posterior wings, where it is divided only by the nervures and a black line down the middle of the cell; occupying on these wings nearly the basal half of the wing, and extending along the abdominal margin almost to the anal angle. On the anterior wings is a series of round spots of the same colour about equally distant from the first band and the outer margin, and on the posterior wings in the same position a series of lunules likewise ochraceous. The extremity of the cell of the anterior wings has a single spot, and on the outer margin of both wings is a series of spots of the same colour.

Below, the anterior wings are paler, the marginal spots more distinct than near the apex. The posterior wings are ash-coloured, tinged with purple, pale at the base, traversed near the middle by a whitish band, spotted with yellow; and not far from the outer margin by a much-waved band of the same colour. The marginal and submarginal spots of the upper surface are reproduced more distinctly below, and are margined internally with black. Close to the base is a crimson spot, and two or three yellow ones are scattered over the basal half of the wings.

Head, thorax and abdomen black, mingled with gray.

In the collection of the British Museum.

XLIII.—*Notices of new or rare British Animals observed during Cruises in* 1845 *and* 1846. By Robert M'Andrew, Esq., and Professor Edward Forbes.

[Continued from p. 98.]

[With a Plate.]

II. *On the occurrence of a species of* Pelagia *in the British seas.*

On the 23rd of August 1846, when cruising off Mount's Bay, Cornwall, our attention was attracted by some rather large Medusæ which passed the vessel at intervals. The weather was fine and the sea smooth; the Medusæ in question appeared like rose-coloured globes in the water. On capturing some we found they belonged to a species of the genus *Pelagia*, hitherto unnoticed in the British seas.

The following description was drawn up from the living animal (which is figured in Plate IX. fig. 5):—

Disc 2½ inches in diameter; subglobose, slightly depressed above, hyaline and tinged with pink, covered with small reddish orange warts which become obsolete towards the summit; margin with sixteen lobes, each bilobed: each lobule rounded and having a triangularly-lanceolate centre covered with reddish brown warts, which are also seen on the sides of the lobules, but are there not coloured. From beneath the separations of eight of the greater lobes spring as many tentacula: in the notches of the remaining eight are the ocelli. *Ocelli* composed each of an ovate red body (formed of pigment cells and prismatic crystals) suspended by a peduncle from a translucent (ganglionic?) mass, whence radiate fibres (nerves?), and behind which (connected by a nerve?) is a circular cavity containing an otolitic body in continual revolution.

Tentacula pink, simple, hollow, short when contracted and nearly equal throughout, but capable of extreme extension (even to the length of several feet); they consist of an external epidermic series of large pigment cells, forming a sheath or tube which is strengthened within by eight longitudinal ribs or columns of compact contractile granular tissue.

Beneath, the subumbrella presents four dependent arms united at their bases, but separated again so as to form a central cavity with four openings. In the central cavity we find four purple furbelowed reniform ovaries (containing irregularly lobed germs), separated by four masses of contractile tubes (spermathecal?) full of minute swarming bodies (spermatozoa?): the ovaries are fringed by similar tubes. From the gastric cavities run sixteen or more vessels to the margin, obscurely branching.

Arms lanceolate, furbelowed and winged, separated from each other nearly to their bases. Their more solid and central parts are dotted with orange spots; their membranous margins are tinged with rose-colour: a canal perforates their united bases and opens into the central cavity.

This Medusa is highly phosphorescent; when irritated in the water by night it seemed like a globe of fire. The phosphorescence is of an intense light green, and proceeds from a mucus which comes away by handling. It is given out chiefly and most vividly by the warts of the skin—especially by the triangular masses of them on the marginal lobes. The ovaries are also phosphorescent, but require to be strongly irritated. If the under surface of the umbrella be irritated, the warts on the external skin opposite give out light, but not the under surface touched. A little crustacean is parasitic in the gastric cavity of this *Pelagia*. When removed from its dwelling it rushed through the water with rapid and frantic movements, seeking to return.

The species appears to be *Pelagia cyanella* of Peron and Lesueur; *Medusa pelagia* of Linnæus; *Diænæa cyanella* of Lamarck. The *Pelagia denticulata* of Peron and Lesueur and the *Pelagia parthenopensis* of Lesson are scarcely even varieties of the same. It is distinguished from *Pelagia panopyra* by the shortness of the peduncle formed by the united bases of the arms. This character appears however to be a variable one. It is a characteristic inhabitant of the Lusitanian region of the North Atlantic, and extends into the Mediterranean. On the British coasts it is probably confined to the entrance of the Channel.

The *Pelagia noctiluca* of Peron and Lesueur, founded on the *Medusa noctiluca* of Forskal, is scarcely distinct. Forskal, in his 'Fauna Arabica,' has the following pithy notes on its phosphorescence:—"Hæc, si quæ alia, vera est noctiluca. Multis experimentis in mari Mediterraneo, ubi habitat, præsertim sub insula Majorca institutis, mihi patuit, illam valde phosphoream esse; e margine lucem fortiorem emittet, quam e nucleo. [This is true; the warts which phosphoresce most strongly being very small and few on the centre of the disc.] Lacerata et in mare projecta, lucida via ad fundum descendebant fragmina. Partes discerptæ, aquæ marinæ in vasculo mixtæ et quassatæ copiose scintillant, et stagnando aquam cito corrumpunt. In cribello aquam superfudi; quæ dum transibat, partes istæ innumeris radiabant stellulis: et sæpe affusa aqua, lumen non minuebant. Id memorabile est, et magni canonis instar in hac experientia: aquam marinam per chartam bibulam percolatam lucendi vim perdere. Innumera Medusarum integrarum copia, ut corpora undis attrita vel rupta, succumque gelatinosum effundentia totidem certe phosphoros accendunt: hinc tamen theoriam universa-

lem alii deducant, ego non. Lente et modeste perpendant Medusæ ne virtutem hanc obtineant ex aqua, vel hæc a Medusis immensis scilicet Oceanus minimæ sui parti tanta miracula debebit !"

XLIV.—*Characters of undescribed* Chalcidites *collected in North America by* E. Doubleday, Esq., *and now in the British Museum.* By Francis Walker, F.L.S.

1. Pteromalus Lausus, fem. *Niger, abdomen viridi cupreo et purpureo varium, antennæ piceæ, pedes flavo-fulvi, femora nigra, alæ sublimpidæ.*

Corpus breve, crassum, convexum, nigrum, obscurum, scitissime squameum, pilis albis hirtum: caput transversum, breve, thoracis latitudine; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: os piceum: antennæ piceæ, graciles, extrorsum crassiores, thorace paullo longiores; articulus 1^{us} longus, linearis, fulvus; 2^{us} fuscus, cyathiformis; 3^{us} et 4^{us} minimi; 5^{us} et sequentes sat longi, usque ad 10^{um} curtantes; clava fusiformis, apice ferruginea, articulo 10^{o} paullo latior et multo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum brevi-obconicum: metathorax brevis, declivis: petiolus brevissimus: abdomen ovatum, nitens, læve, nigro-viride, basi cupreo et purpureo varium, supra planum, subtus profunde carinatum, apice acuminatum, thorace paullo longius vix angustius; segmentum 1^{um} magnum; 2^{um} et sequentia breviora, subæqualia: pedes nigri, simplices, subæquales; trochanteres picei; genua fulva; protarsi fulvi; mesotarsi et metatarsi flavi, apice fusci: alæ sublimpidæ; squamulæ piceæ; nervi fusci; nervus humeralis fulvus ulnari paullo longior, ulnaris valida radiali fere duplo longior, cubitalis radiali paullo brevior; stigma sat magnum, obscurius. (Corp. long. lin. $1\frac{3}{4}$; alar. lin. 3.)

It is allied to *Pteromalus intermedius*, *Eutelus intermedius*, Ent. Mag. ii. 366.

2. Pteromalus Cratylus, fem. *Ater, abdomen nigro-æneum, antennæ piceæ, pedes flavi, femora nigra, alæ limpidæ.*

Corpus breve, latum, crassum, convexum, atrum, obscurum, scitissime squameum, parce hirtum: caput transversum, breve, thorace paullo latius; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennæ piceæ, subclavatæ, graciles, thorace paullo longiores; articulus 1^{us} fulvus, longus, linearis; 2^{us} cyathiformis; 3^{us} et 4^{us} minimi; 5^{us} et sequentes mediocres, usque ad 10^{um} curtantes et latescentes; clava conica, acuminata, articulo 10^{o} duplo longior: thorax brevi-ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum obconicum: metathorax brevis, declivis: petiolus brevissimus: abdomen nigro-æneum, brevi-ovatum, nitens,

læve, supra planum, subtus carinatum, apice acuminatum, thoracis longitudine et latitudine: pedes flavi, simplices, subæquales; coxæ nigræ; femora nigra, apice flava; tarsi apice fusci: alæ limpidæ; squamulæ fulvæ; nervi flavi; nervus humeralis ulnari multo longior, radialis ulnari brevior cubitali vix longior; stigma minutum. (Corp. long. lin. $1\frac{1}{4}$; alar. lin. 2.)

This is also allied to *Pt. intermedius*.

3. Pteromalus Cassotis, fem. *Ater, abdomen cupreum, antennæ piceæ, pedes fulvi, tarsi flavi, alæ limpidæ.*

Corpus breve, latum, convexum, atrum, obscurum, scitissime squameum, parce hirtum: caput transversum, breve, thorace latius; vertex latus; frons impressa, abrupte declivis: oculi rufi, mediocres, non extantes: antennæ piceæ, clavatæ, thorace non longiores; articulus 1^{us} fulvus, longus, gracilis; 2^{us} longicyathiformis; 3^{us} et 4^{us} minimi; 5^{us} et sequentes breves, usque ad 10^{um} paullo curtantes et latescentes; clava conica, acuminata, articulo 10^{o} paullo latior et duplo longior: thorax ovatus: prothorax transversus, brevis: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum subconicum: metathorax mediocris, declivis, obconicus: petiolus brevissimus: abdomen brevi-ovatum, nitens, læve, cupreum, basi viridi cupreo et purpureo micans, supra planum, subtus carinatum, apice acuminatum, thorace brevius non angustius: pedes fulvi, simplices, subæquales; coxæ nigræ; mesotarsi et metatarsi flavi, apice fusci: alæ limpidæ; squamulæ fulvæ; nervi fulvi; nervus humeralis ulnari multo longior, radialis cubitali longior; stigma parvum. (Corp. long. lin. $1\frac{1}{4}$; alar. lin. 2.)

Allied to *Pt. deplanatus*, Nees d'Essenbeck Hym. Ich. aff. ii. 110.

4. Pteromalus Euthymus, mas. *Ater, abdomen nigro-cupreum, antennæ piceæ, pedes fulvi, femora picea, tarsi flavi, alæ limpidæ.*

Corpus breve, latum, convexum, nigrum, obscurum, scitissime squameum, parce hirtum: caput transversum, breve, magnum, thorace latius; vertex latus; frons impressa, abrupte declivis: oculi rufi, mediocres, non extantes: antennæ piceæ, clavatæ, thorace non longiores; articulus 1^{us} fulvus, longus, gracilis; 2^{us} longicyathiformis; 3^{us} et 4^{us} minimi; 5^{us} et sequentes usque ad 10^{um} breves, subæquales, discreti; clava conica, acuminata, articulo 10^{o} paullo latior et duplo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ non bene determinatæ; scutellum subconicum: metathorax mediocris, obconicus, declivis: petiolus brevissimus: abdomen subconicum, depressum, nitens, nigro-cupreum, læve, basi angustum, thorace brevius et multo angustius et humilius; segmentum 1^{um} magnum, 2^{um} et sequentia brevia: pedes fulvi, simplices, subæquales; coxæ nigræ; femora picea, basi et apice fulva; mesotarsi et metatarsi flavi, apice fusci: alæ limpidæ; squamulæ piceæ; nervi fulvi; nervus humeralis ulnari multo longior, radialis ulnari paullo brevior cubitali longior; stigma fuscum, parvum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{1}{2}$.)

Allied to *Psilocera obscura*, Ent. Mag. i. 374.

5. Pteromalus Dipsas, fem. *Nigro-æneus, pedes fulvo-picei, femora nigro-picea, tarsi flavi, alæ limpidæ.*

Corpus nigro-æneum, convexum, obscurum, scitissime squameum, parce hirtum: caput transversum, breve, thoracis latitudine; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennis articulus 1^{us} fulvus, longus, gracilis; 2^{us} fuscus: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum subrotundum: metathorax brevis, declivis: petiolus brevissimus: abdomen ovatum, nitens, læve, supra planum, subtus carinatum, apice acuminatum, thorace paullo brevius et angustius: pedes fulvi, simplices, subæquales; coxæ nigræ; trochanteres picei; femora nigro-picea; mesopedum et metapedum tibiæ fuscæ, tarsi flavi apice fusci: alæ limpidæ; squamulæ piceæ; nervus humeralis ulnari multo longior, radialis ulnari multo brevior cubitali paullo longior; stigma parvum. (Corp. long. lin. 1; alar. lin. $1\frac{3}{4}$.)

Allied to *Pt. discolor*, Ent. Mag. iii. 473.

6. Pteromalus Hermeas, fem. *Niger, antennæ nigræ, pedes fulvi, femora nigra, tarsi flavi, alæ limpidæ.*

Corpus angustum, convexum, nigrum, parum nitens, scitissime squameum, parce hirtum: caput transversum, breve, thorace paullo latius; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennæ nigræ, graciles, subclavatæ, thorace non longiores; articulus 1^{us} longus, linearis; 2^{us} longicyathiformis; 3^{us} et 4^{us} minimi; 5^{us} et sequentes mediocres, usque ad 10^{um} curtantes et latescentes; clava conica, acuminata, articulo 10^{o} multo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum brevi-obconicum: metathorax brevis, declivis: petiolus brevissimus: abdomen fusiforme, nitens, læve, supra depressum, subtus profunde carinatum, apice acuminatum, thorace longius et angustius: pedes fulvi; coxæ nigræ; trochanteres picei; femora nigra; mesotarsi et metatarsi flavi, apice fusci: alæ limpidæ; squamulæ fulvæ; nervi flavi; nervus humeralis ulnari multo longior, radialis ulnari brevior cubitali longior; stigma minimum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{1}{4}$.)

Allied to *Pt. hemipterus*, Ent. Mag. iii. 196.

7. Pteromalus Epicles, fem. *Cyaneo-viridis, abdomen cupreo et purpureo varium, antennæ nigræ, pedes fulvi, femora nigro-picea, tarsi albidi, alæ albo limpidæ.*

Corpus breve, crassum, latum, convexum, cyaneo-viride, parum nitens, scitissime squameum, parce hirtum: caput transversum, breve, thorace vix latius; vertex latus; frons impressa, abrupte declivis: oculi rufi, mediocres, non extantes: antennis articulus 1^{us} longus, gracilis, niger, basi fulvus: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ non bene determinatæ, postice approximatæ; scutellum obconicum: metathorax brevis, declivis: petiolus brevissimus:

abdomen ovatum, nitens, læve, cyaneo cupreo et purpureo varium, supra planum, subtus profunde carinatum, apice acuminatum, thorace angustius non longius: oviductus fulvus abdominis basi subtus emissus: pedes fulvi; coxæ nigro-virides; trochanteres picei; femora nigro-picea; mesotarsi et metatarsi albidi, apice fusci: alæ albido limpidæ; squamulæ fulvæ; nervi pallide flavi; nervus humeralis ulnari multo longior, radialis ulnari brevior cubitali longior; stigma minutum. (Corp. long. lin. $1\frac{1}{4}$; alar. lin. 2.)

Allied to *Pteromalus altus*, *Eutelus altus*, Ent. Mag. ii. 367.

8. Pteromalus Damo, fem. *Cupreus, abdomen basi viridi varium, pedes fulvi, tarsi flavi, alæ subfulvæ.*

Corpus angustum, sublineare, convexum, cupreum, parum nitens, scitissime squameum, parce hirtum: caput ademptum: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum obconicum: metathorax mediocris, obconicus, declivis: petiolus brevissimus: abdomen fusiforme, nitens, læve, basi viridi varium, supra depressum, subtus profunde carinatum, apice acuminatum, thorace paullo angustius et multo longius: pedes fulvi; coxæ cupreæ; mesotarsi et metatarsi flavi, apice fusci: alæ subfulvæ; squamulæ fulvæ; nervi flavi; nervus humeralis ulnari multo longior, radialis ulnari brevior cubitali longior; stigma minutum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{1}{4}$.)

Allied to *Pt. tenuis*, Ent. Mag. ii. 498.

9. Pteromalus Œax, fem. *Nigro-æneus, abdomen æneum, antennæ fuscæ, pedes fulvi, tarsi flavi, alæ limpidæ.*

Corpus angustum, nigro-æneum, convexum, nitens, scitissime squameum, parce hirtum: caput transversum, breve, thorace latius; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennæ fuscæ, clavatæ, thorace non longiores; articulus 1^{us} fulvus, longus, gracilis; 2^{us} cyathiformis; 3^{us} et 4^{us} minuti; 5^{us} et sequentes transversi, usque ad 10^{um} curtantes; clava ovata, acuminata, articulo 10^{o} latior et duplo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum obconicum: metathorax mediocris, declivis, obconicus: petiolus brevissimus: abdomen fusiforme, æneum, læve, supra depressum, subtus profunde carinatum, apice attenuatum et acuminatum, thorace angustius et multo longius: pedes fulvi, simplices, subæquales; coxæ æneæ; mesotarsi et metatarsi flavi, apice obscuriores: alæ limpidæ; squamulæ piceæ; nervi fulvi; nervus humeralis ulnari multo longior, radialis ulnari brevior, cubitalis sat longus; stigma minutum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{1}{4}$.)

Perhaps a variety of *Pt. Damo*.

10. Pteromalus Doryssus, mas. *Niger, antennæ piceæ, pedes fulvi, femora nigro-picea, tarsi flavi, alæ limpidæ.*

Corpus angustum, convexum, nigrum, parum nitens, scitissime squameum, parce hirtum: caput transversum, breve, thorace paullo

latius; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennæ piceæ, validæ, subfiliformes, thorace non longiores; articulus 1^{us} fulvus, longus, gracilis; 2^{us} cyathiformis; 3^{us} et 4^{us} minimi; 5^{us} et sequentes usque ad 10^{um} mediocres, subæquales; clava conica, compressa, acuminata, articulo 10^{o} multo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum obconicum: metathorax sat magnus, obconicus, declivis: petiolus brevissimus: abdomen sublineare, nitens, læve, depressum, thorace multo angustius non brevius: pedes fulvi, simplices, subæquales; coxæ nigræ; femora nigro-picea; meso- et metatarsi flavi, apice fusci: alæ limpidæ; squamulæ piceæ; nervi fulvi; nervus humeralis ulnari multo longior, radialis ulnari brevior, cubitali longior; stigma minutum. (Corp. long. lin. $1\frac{1}{4}$; alar. lin. $2\frac{1}{4}$.)

Allied to *Pteromalus Zonaras*, Mon. Chal. i. 227.

11. Pteromalus Timæa, fem. *Ater, abdomen nigro-purpureum, antennæ piceæ, pedes nigri, tarsi flavi, alæ limpidæ.*

Corpus crassum, atrum, convexum, parum nitens, scitissime squameum, parce hirtum: caput transversum, breve, thorace paullo latius; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennæ piceæ, clavatæ, thorace non longiores; articulus 1^{us} niger, longus, gracilis; 2^{us} longicyathiformis; 3^{us} et 4^{us} minimi; 5^{us} et sequentes mediocres, usque ad 10^{um} curtantes et latescentes; clava ovata, articulo 10^{o} latior et duplo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ non bene determinatæ; scutellum brevi-obconicum: metathorax brevis, declivis: petiolus brevissimus: abdomen fusiforme, nigro-purpureum, nitens, læve, basi cyaneo-micans, supra depressum, subtus carinatum, apice acuminatum, thorace paullo longius et multo angustius: pedes nigri; trochanteres picei; genua fulva; protarsi fulvi; mesotarsi et metatarsi flavi, apice fusci: alæ limpidæ; squamulæ piceæ; nervi flavi; nervus humeralis ulnari multo longior, radialis ulnari brevior cubitali longior; stigma minutum. (Corp. long. lin. $1\frac{1}{4}$; alar. lin. 2.)

12. Pteromalus Orontas, fem. *Ater, abdomen viride, discus purpureus, antennæ nigræ, pedes nigro-picei, tarsi flavi, alæ limpidæ.*

Corpus angustum, convexum, nigrum, parum nitens, scitissime squameum, parce hirtum: caput transversum, breve, thorace paullo latius; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennæ clavatæ, nigræ, thorace non longiores; articulus 1^{us} longus, gracilis, 2^{us} longicyathiformis; 3^{us} et 4^{us} minimi; 5^{us} et sequentes mediocres, usque ad 10^{um} latescentes; clava ovata, acuminata, articulo 10^{o} latior et duplo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum subconicum: metathorax brevis, declivis: petiolus brevissimus: abdomen longiovatum, viride, nitens, læve, supra depressum, subtus carinatum,

apice acuminatum, thorace angustius et longius ; discus purpureus : pedes nigri, simplices, subæquales ; trochanteres picei ; genua fulva ; tibiæ piceæ ; protarsi fulvi ; mesotarsi et metatarsi flavi, apice fusci : alæ limpidæ ; squamulæ piceæ ; nervi flavi ; nervus humeralis ulnari longior, radialis ulnari brevior cubitali longior ; stigma minutum. (Corp. long. lin. 1 ; alar. lin. $1\frac{1}{2}$.)

13. Pteromalus Dymnus, fem. *Ater, abdomen viridi-æneum, antennæ piceæ, pedes nigri, tarsi flavi, alæ limpidæ.*

Corpus validum, convexum, nigrum, parum nitens, scitissime squameum, parce hirtum : caput transversum, breve, thoracis latitudine ; vertex latus ; frons impressa, abrupte declivis : oculi picei, mediocres, non extantes : antennæ piceæ, clavatæ, thorace non longiores ; articulus 1us longus, gracilis ; 2us cyathiformis ; 3us et 4us minimi ; 5us et sequentes mediocres, usque ad 10um curtantes ; clava conica, articulo 10o multo longior : thorax ovatus, pilis albis hirtus : prothorax transversus, brevissimus : mesothoracis scutum longitudine latius ; parapsidum suturæ vix conspicuæ : metathorax brevis, declivis : petiolus brevissimus : abdomen longiovatum, viridi-æneum, nitens, læve, supra depressum, subtus carinatum, apice acuminatum, thorace paullo longius et angustius : pedes nigri, simplices, subæquales ; trochanteres picei ; genua fulva ; protarsi fulvi ; mesotarsi et metatarsi flavi, apice fusci : alæ limpidæ, sat latæ ; squamulæ piceæ ; nervi pallide flavi ; nervus humeralis ulnari multo longior, radialis ulnari brevior cubitali longior ; stigma fuscum, parvum. (Corp. long. lin. 1 ; alar. lin. $1\frac{3}{4}$.)

14. Pteromalus Eryx, mas. *Ater, abdomen cyaneum, discus cupreus, pedes flavi, metatibiæ fusco cinctæ, alæ limpidæ.*

Corpus sublineare, convexum, nigrum, obscurum, scitissime squameum, parce hirtum, subtus nigro-cyaneum : caput ademptum : thorax longiovatus, pilis albis hirtus : prothorax transversus, brevissimus : mesothoracis scutum longitudine latius ; parapsidum suturæ non bene determinatæ ; scutellum brevi-conicum : metathorax mediocris, obconicus, declivis : petiolus brevissimus : abdomen sublineare, cyaneum, nitens, læve, depressum, thorace angustius non longius ; discus cupreus : sexualia fulva : pedes pallide flavi, simplices, subæquales ; coxæ cyaneæ ; trochanteres picei ; metatibiæ fusco-cinctæ ; protarsi fulvi : alæ limpidæ ; squamulæ piceæ ; nervi pallide flavi ; nervus humeralis ulnari multo longior, radialis ulnari brevior cubitali longior ; stigma minutum. (Corp. long. lin. $1\frac{1}{4}$; alar. lin. $2\frac{1}{4}$.)

15. Pteromalus Hybreas, fem. *Æneo-ater, abdomen cupreum, antennæ nigræ, pedes fulvi, tarsi flavi, alæ limpidæ.*

Corpus sublineare, æneo-atrum, convexum, parum nitens, scitissime squameum, pilis albis hirtum : caput transversum, breve, magnum, thorace multo latius ; vertex latus ; frons impressa, abrupte declivis : oculi rufi, mediocres, non extantes : antennæ nigræ, graciles, extrorsum crassiores, thorace non breviores ; articulus 1us longus, linearis ; 2us cyathiformis, piceus ; 3us et 4us minimi ; 5us et sequentes

mediocres, usque ad 10um paullatim curtantes; clava conica, acuminata, articulo 10o multo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum brevi-obconicum: metathorax mediocris, obconicus, declivis; petiolus brevissimus: abdomen longiovatum, cupreum, nitens, læve, supra planum, subtus vix carinatum, apice acuminatum, thorace paullo longius vix latius; segmenta subæqualia: pedes fulvi, simplices, subæquales; coxæ nigræ; mesotarsi et metatarsi flavi, apice fusci: alæ limpidæ; squamulæ fulvæ; nervi fulvi; nervus humeralis ulnari multo longior, radialis ulnari vix brevior cubitali multo longior; stigma minutum. (Corp. long. lin. $1\frac{3}{4}$; alar. lin. 3.)

16. Pteromalus Eurypon, fem. *Ater, abdomen cupreum, antennæ piceæ, pedes fulvi, tarsi flavi, alæ limpidæ.*

Corpus convexum, atrum, parum nitens, scitissime squameum, pilis albis hirtum: caput transversum, breve, magnum, thorace multo latius; vertex latus; frons impressa, abrupte declivis: oculi rufi, mediocres, non extantes: antennæ piceæ, subclavatæ, thorace longiores; articulus 1us fulvus, longus, gracilis; 2us cyathiformis; 3us et 4us minimi; 5us et sequentes mediocres, usque ad 10um paullatim curtantes; clava longiconica, acuminata, articulo 10o duplo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ vix conspicuæ; scutellum brevi-obconicum: metathorax mediocris, obconicus, declivis: petiolus brevis: abdomen longiovatum, nitens, læve, cupreum, viridi et æneo-varium, supra depressum, subtus carinatum, apice acuminatum, thorace paullo longius et angustius: pedes fulvi, simplices, subæquales: coxæ nigræ; mesotarsi et metatarsi flavi, apice obscuriores: alæ limpidæ; squamulæ piceæ; nervi fulvi; nervus humeralis ulnari multo longior, radialis ulnari paullo brevior cubitali longior; stigma minutum. (Corp. long. lin. $1\frac{1}{4}$; alar. lin. 2.)

[To be continued.]

BIBLIOGRAPHICAL NOTICES.

Flore de l'Algérie, ou Catalogue des Plantes indigènes du Royaume d'Alger. Par G. Munby: Paris, 1847. Pp. 120. Six plates.

This account of the plants of French Africa is the work of a well-known English botanist who has settled in Algeria. It is a valuable contribution towards our knowledge of the flowering plants of the great Mediterranean province. Our acquaintance with the Algerine flora has hitherto been derived mainly from the admirable 'Flora Atlantica' of Desfontaines, published in 1798. During 1842 and 1843 the botany of Algeria was explored by the Members of the Scientific Commission, under the late M. Bory St. Vincent, sent by the French Government. The botanical researches were conducted chiefly by M. Durieu, and have not as yet been published. Mr. Munby has

herborized this region, however, during a longer period—the interval between the spring of 1839 and the close of last year. The provinces of Algiers and Oran have been the chief fields of his labours, and in those districts he has added no fewer than thirty genera and 200 species (including ten entirely new) to the lists published by Desfontaines. Eighteen hundred species, exclusive of cultivated plants, are enumerated in this catalogue. They are arranged in Linnæan order for convenience of reference to the 'Flora Atlantica.' This is a defect, and renders the book not so convenient as it might be for a work of reference.

The new species described by Mr. Munby are the following:—*Orchis sagittata, Galium brunneum, Phlomis mauritanica, Melissa candidissima, Genista barbara, Ononis spicata, Anthyllis bidentata, Lathyrus luteus, Hippocrepis minor* and *Cistus sericeus.* There are enumerated also several unpublished or little-known plants, of which we may expect an account when the researches of the French commission are published—as, *Boucerosia Munbyana,* Decaisne, *Narcissus Clusii,* Dunal, *Arisarum aspergillum,* Dunal, *Biarum Borei,* Decaisne, *Anthemis piscinalis,* Durieu, *Medicago corrugata,* Durieu, *Cistus Clusii,* Dunal, and *Helianthemum pomeridianum,* Dunal.

Among the genera added to the Algerine flora are *Epilobium, Agrimonia, Thalictrum, Cochlearia, Coronopus, Succowia, Morecandia, Sida, Leobordia, Androsæmum* (*officinale*), *Podospermum* and *Geropogon.* Among the more interesting species are *Iris filifolia* of Boissier; *Ctenium elegans* of Kunth, brought from the desert of Angad, whence also comes *Ranunculus gramineus* var. *luzulæfolius,* and a beautiful *Salvia* identified by the author, probably incorrectly, with *Salvia lanata,* Roxburgh, a Himalayan plant; *Phlomis floccosa, Helianthemum caput felis, Lycium intricatum, Convolvulus tenuissimus* and *Rosa Sherardi.*

It is probable that Desfontaines was mistaken in the identification of many of his species, for we find in such genera as *Ranunculus, Veronica, Medicago, Helianthemum, Cyperus* and *Carex,* that many of the species marked by him as common have not been found by Mr. Munby, who found however allied species not mentioned by the French botanist. Thus *Veronica Cymbalaria* appears by Desfontaines to have been enumerated as *V. hederæfolia, V. præcox* as *arvensis, Ranunculus ophioglossifolius* as *R. Flammula, Geranium aconitifolium* as *G. sylvaticum,* and *Bellis sylvestris* as *Doronicum bellidiastrum.*

Among the plants enumerated by Mr. Munby is the *Nitraria tridentata* of Desfontaines, brought from the desert of Soussa near Tunis. He conjectures this to be the true Lotus-tree of the ancients. It is called *Damouch* by the Arabs, who are aware of the semi-intoxicating qualities of its berry, much more likely to give rise to the fame of the Lotus than the dry and unpleasant fruit of the *Zizyphus lotus,* or that of the *Celtis australis,* to which the infatuating food of the Lotophagi has been in turn referred. The locality of the *Nitraria* would also agree well with the realm of the famous Lotus-tree.

E. F.

The Ancient World; or Picturesque Sketches of Creation. By D. T. Ansted, M.A., F.R.S. &c. Post 8vo, with 149 Illustrations. Van Voorst.

The grandeur of the phænomena with which geologists deal, and the abundant use they have made of the free scope for generalization afforded, have enabled them to take a firmer hold upon popular attention than any of their scientific brethren—the organic chemists of the last few years not excepted. There is a greater breadth as it may be called about the nature of geological facts, and for the comprehension of its more general principles, less application to minute detail is required, so that a large class of persons find interest in and opportunity of acquiring a certain amount of information as to the causes which have been at work in the production of the present structure of the earth they live on, who would not, in these busy times, think it worth while to inquire into the nature and habits of the animals and plants around them.

The dependence however of Geology upon Palæontology has opened a new source of interest in the history of organic life, and the speculations which have arisen out of the investigations of the successive phases presented during the world's existence by the animal and vegetable kingdoms, have within a recent period been "common talk,"—with how much profit to the generality of persons we will not stop here to examine.

Prof. Ansted has done a good service in affording to the unscientific public a record of the real facts of Palæontology, and an authoritative account of the extent to which generalization has as yet been safely carried; and although his book may want some of the poetic richness which has embellished the imaginings of the "development" theorists, we believe that the sincere and earnest exposition of his subject will not be the less attractive.

The vividness of some of his "picturesque sketches," in which he successively groups together the most striking features of the various geologic periods, we may illustrate by an extract. Speaking of Europe during the formation of the older tertiaries, he says:—

"The shores of the islands or of the tract of main land then existing were apparently low and swampy, rivers bringing down mud in what is now the south-east of England and the neighbourhood of Brussels, but extensive calcareous beds near Paris. Deep inlets of the sea, estuaries and the shifting mouths of a river, were also affected by numerous alterations of level, not sufficient to destroy, but powerful enough to modify the animal and vegetable species then existing; and these movements were continued for a long time. The seas were tenanted by sharks, gigantic rays, and many other fishes of warm latitudes, and abounded also with large carnivorous mollusca, capable of living either in fresh or brackish water. The shelving land was clothed with rich tropical vegetation to the water's edge, presenting to view the palm and the cocoa-nut, besides many of those trees which now lend a charm to the Spice Islands of the Indian Seas. All these abounded also with indications of animal life.

"The large rivers were peopled with crocodiles; turtles and porpoises floated upon them; and these tenants of the water, strange and varied as they were, and unlike the present inhabitants of the district, were not without resemblance to many species still met with on the earth.

"The interior of the land, of which the surrounding waters were thus peopled, was no less remarkable, and exhibited appearances no less instructive. Troops of monkeys might be seen skipping lightly from branch to branch in the various trees, or heard mowing and chattering and howling in the deep recesses of the forest. Of the birds, some, clothed in plumage of almost tropical brilliancy, were busy in the forests, while others, such as the vulture, hovered over the spots where death had been busy. Gigantic serpents might have been seen insidiously watching their prey. Other serpents in gaudy dress were darting upon the smaller quadrupeds and birds, and insects glittered brightly in the sun. All these indications of life and activity existed, and that, too, not far distant from the spots on which are placed the two most important cities in the world. But this happened not only before our island was visited by its earliest human discoverer, but long before man had been introduced on the earth."

The illustrations of the work (which is gorgeously "got up") deserve much praise; the absence of complicated detail renders their comprehension more easy by general readers.

Altogether this is a welcome addition to a class of books which we hope to see increase, namely popular scientific works written by scientific men.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Feb. 23, 1847.—William Yarrell, Esq., Vice-President, in the Chair.

DRAFTS FOR AN ARRANGEMENT OF THE TROCHILIDÆ, WITH DESCRIPTIONS OF SOME NEW SPECIES. BY JOHN GOULD, F.R.S.

Genus PETASOPHORA, G. R. Gray (*Heliothryx*, Boie; *Ramphodon*, Less.; *Colibri*, Spix).

This is one of the best-defined groups of the family, and is distinguished by several peculiarities, the principal of which are the greatly developed ear-coverts and their blue colour, and the similarity in the colouring of the sexes, the females possessing all the brilliancy of the males and only distinguishable from them by their smaller size and more delicate contour: the young too assume the plumage of the adult.

The oldest known species of this form constitutes the type; it is the

Sp. 1. PETASOPHORA SERRIROSTRIS.

Trochilus serrirostris, Vieill. Nouv. Dict. tom. vii. p. 359; Ency. Méth. part 2. p. 561; Ois. Dor. tom. iii. pl. 1. ined.

Ornismya petasophora, Less. Ois. Mon. pl. 1; Ib. Troc. pls. 12 & 59; Pr. Max. de Wied, sp. 10; Temm. Pl. Col. 203. fig. 3; Jard. Nat. Lib. vol. i. p. 120. pl. 13, male; vol. ii. p. 81. pl. 15, fem.

Petasophora serrirostris, G. R. Gray, List of Gen. of Birds, 2nd edit. p. 17.

Hab. Brazil.

Sp. 2. Petasophora cyanotus.

Trochilus cyanotus, Bourc. Rev. Zool. 1843, p. 1; Ann. de Lyons, tom. vi. p. 41, but not the *cyanotus* stated by Lesson to be synonymous with *Delphinæ*.

This species appears to be the representative in the Cordilleras of the *P. serrirostris* of the Brazils, from which it is at once distinguished by the blue colouring of the ear-coverts.

Hab. Bogota.

Sp. 3. Petasophora thalassina.

Trochilus thalassinus, Swains. Syn. Birds of Mexico, in Phil. Mag. June 1827, p. 441.

Differs from the other members of the genus by being of a smaller size and by the greater extent of the blue on the cheeks and ear-coverts; it has also a slight wash of blue on the chin and centre of the abdomen.

Hab. Mexico.

Sp. 4. Petasophora Anais.

Ornismya Anais, Less. Col. Supp. pl. 3; Less. Troc. pls. 55, 56, 57; Rev. Zool. 1838, p. 315, 1839, p. 19; Less. Velin, no. 11; Echo du Monde savante, 1843, no. 31. ined. pl. 11.

Much confusion evidently exists with respect to this species, M. Lesson having figured one bird and described another with the same appellation; under these circumstances it will be to the advantage of science to retain the specific term *Anais* for the bird best known to ornithologists by that designation, the species so common in all collections from Bogota, the *great Anais* of the French, and which is a very fine species, distinguished by the existence of a well-defined band of blue on the throat. The female is fully as bright as the male, but at least one-third smaller in size.

Hab. Venezuela and all the Cordilleras in the neighbourhood of Bogota.

Sp. 5. Petasophora iolota, sp. nov. *Pet. capite, et corpore superiore saturatè viridibus; mento, spatio suboculari, auribus, et medio abdomine intensè, metallicè, cyaneis; corpore inferiore nitense viridi; gulâ quasi tessellatâ, quia mediæ plumæ quam pogoniæ extremæ obscurius nitent; tectricibus caudæ inferioribus pallidis ad margines pallidioribus.*

Head and all the upper surface deep green, in some specimens tinged with gold; primaries and secondaries brown, tinged with purple; chin, space beneath the eye, ear-coverts and the centre of

the abdomen rich deep metallic blue; all the under surface rich deep glossy green, the throat presenting a tessellated appearance, occasioned by the reflection from the webs throwing a darker hue on the centre of each feather; under tail-coverts pale, with lighter margins; two centre tail-feathers golden green, the remainder steel or bluish shining green, crossed near the extremity by a broad band, which is dull black on the upper surface and shining steel-blue on the under; bill and feet black.

Total length, $5\frac{3}{4}$ inches; bill, $1\frac{3}{8}$; wing, $3\frac{3}{8}$; tail, $2\frac{1}{2}$.

The female is similar to the male in plumage, but smaller in size.

Nearly allied to the preceding, but larger and finer in every respect.

Hab. Bolivia.

Sp. 6. Petasophora coruscans.

Vide Proc. of Zool. Soc. Part 14. pp. 44 & 90.

Sp. 7. Petasophora Delphinæ.

O. Delphinæ, Less. Rev. Zool. 1839, p. 44; Echo du Monde savante, 1843, no. 31; Less. Ill. de Zool. tom. ii. 1832, pl. 64.

Sp. 8. Petasophora? Geoffroyi.

Trochilus Geoffroyi, Bourc. et Muls. Ann. de Lyons, tom. vi. p. 37.

It will probably be necessary at some future period to make this the type of a new genus.

The eight species enumerated above comprise every member of this beautiful genus with which I am acquainted; I possess, however, some immature specimens which may be referable to a ninth species, in which case it will prove to be most nearly allied to *P. serrirostris*. They differ from that bird in having the two outer tail-feathers rather largely tipped with white, the lower part of the abdomen greyish white, and in the ear-coverts being very diminutive. Although I have little doubt of their being distinct, I prefer seeing other specimens before characterizing them.

Genus Oreotrochilus, n. g.

Rostrum capite longius, subcylindricum, paulo incurvum. *Alæ* subgrandes valentes. *Cauda* magna, rotundata, rectricibus attenuatis, submucronatis, rigidis. *Pedes* fortes. *Digitus* et unguis postici digito et ungui mediis longitudine æquales. *Tarsi* plumis vestiti. *Gula* luminosa infra torquata.

Gen. Char.—Bill longer than the head, almost cylindrical, but slightly curved downwards; wings rather large and powerful; tail large and rounded, the feathers narrow, rather pointed and rigid; feet strong, the hind-toe and nail about equal in length to the middle toe and nail; tarsi clothed with feathers. Throat luminous, bounded below by a distinct collar.

I propose this term as a generic appellation for a section of the *Trochilidæ*, which has hitherto only been found immediately beneath the line of perpetual congelation, where they feed upon the insects which resort to the newly expanded flowers. The type is

Sp. 1. OREOTROCHILUS ESTELLA.

Orthorhynchus Estella, D'Orb. Voy. Am. Birds, pl. 6. fig. 1; D'Orb. et La Fres. in Guerin's Mag. de Zool. 1838, p. 31.

O. Ceciliæ, Less. Rev. Zool. 1839, p. 43.

Sp. 2. OREOTROCHILUS LEUCOPLEURUS, sp. nov. *Oreot. capite, corpore superiore, alisque, olivaceo-fuscis, griseo tinctis; tectricibus caudæ superioribus sordidè æneo-viridibus; rectricibus duabus intermediis viridibus, æneo splendentibus; rectricibus lateralibus sordidè albis, apicibus et marginibus exterioribus fuscis; gulâ luminosè viridi, fasciâ semilunari holosericâ atrâ infrâ ornatâ; medio abdomine lateribusque nigris; mediis sed lateribus et pectore albis.*

Head, all the upper surface and wings greyish olive-brown, passing into dull coppery green on the upper tail-coverts; two centre tail-feathers green, with bronze reflections; lateral tail-feathers dull white, margined externally and tipped, dull brown gradually blending into the white; throat rich luminous grass-green, bounded below by a crescentic band of deep velvety black; breast and centre of the flanks pure white; the remainder of the flanks and centre of the abdomen bluish black; feet dark olive-brown; bill black.

Total length, $4\frac{3}{4}$ inches; bill, 1; wing, $3\frac{1}{4}$; tail, $2\frac{3}{8}$.

This species is nearly allied to the preceding, but differs from it in being somewhat smaller and in having the centre of the abdomen black instead of chestnut.

Hab. The Chilian Cordilleras.

Sp. 3. OREOTROCHILUS CHIMBORAZO.

T. Chimborazo, Bourc. in Rev. Zool. Sept. 1846, p. 305.

Sp. 4. OREOTROCHILUS ADELA.

Orthorhynchus Adela, D'Orb. Voy. Am. Birds, pl. 61. fig. 2; D'Orb. et La Fres. Mag. de Zool. 1839.

Sp. 5. OREOTROCHILUS MELANOGASTER, sp. nov. *Oreot. omni corpore superiore olivaceo-fusco aureo nitente, tectricibus caudæ superioribus viridi lavatis; alis griseo-fuscis purpureo splendentibus; gulâ fulgente viridi, pectore et abdomine intensè cyaneo-atris.*

All the upper surface olive-brown, with a golden lustre, and washed with green on the upper tail-coverts; wings greyish brown, with purple reflections; throat rich lustrous grass-green; breast and abdomen rich deep bluish black; flanks rusty brown; tail green, with bronze reflections; bill black; feet olive-black.

Total length, 5 inches; bill, 1; wing, $3\frac{1}{4}$; tail, $2\frac{1}{4}$.

Hab. unknown.

This fine species is in the collection of Mr. John Leadbeater, to whom I am indebted for the loan of it for the purpose of describing.

Mr. Gould then described a fourth new species of Humming Bird, belonging to the genus *Calothorax*, as

TROCHILUS (CALOTHORAX) CALLIOPE. *Cal. corpore superiore viridi; alis caudâque griseo-fuscis; gulæ plumis elongatis, atte-*

nuatis, coccineis, basibus albis in formâ stellæ ordinatis; pectore, abdomine medio, tectricibusque caudæ inferioribus, albis; lateribus cervino-albis.

Upper surface green; wings and tail greyish brown; feathers of the throat elongated, narrow, and of a rich pinky scarlet, with white bases arranged in a starred form; breast, centre of the abdomen and under tail-coverts white; flanks buffy white; bill and feet blackish brown.

Total length, $2\frac{1}{2}$ inches; bill, $\frac{5}{8}$; wing, $1\frac{1}{2}$; tail, 1.

This is a very diminutive species, much smaller than the *C. cyanopogon*, but of precisely the same form.

Hab. Mexico; precise locality unknown.

The Secretary, on the part of Dr. Falconer, exhibited the lower end of the left tibia of a gigantic fossil Struthious Bird from the Sewalik Hills. This interesting remain indicates a very close generic representation of the existing African *Struthio* in the extinct fauna of Asia. Although not altogether unexpected, this is a valuable addition to the facts previously demonstrated in relation to the genera *Camelopardalis, Camelus, Elephas,* and *Hippopotamus.*

March 9.—William Yarrell, Esq., Vice-President, in the Chair.

The following communications were read:—

1. Note on the Red Corpuscles of the Blood of the Meminna Deer (*Moschus Meminna*, Erxl.). By George Gulliver, F.R.S.

After I had made known the curious minuteness of the red corpuscles of the blood of that little ruminant the Napu Musk Deer, it was to be expected that these corpuscles would present the same character in the rest of the genus. Accordingly, I some time ago found this to be the case in the Stanley Musk Deer; and it appears, from an examination which I have lately made of the blood-corpuscles of the Meminna Deer, that these are not distinguishable in size from those of the Napu Musk Deer.

The following measurements of the red corpuscles of the blood of the Meminna Deer exactly agree with the measurements of the corresponding corpuscles of the Napu Musk Deer. They are, as usual, given in vulgar fractions of an English inch:—

13400 12000	} Common sizes.
16000	Small size.
9600	Large size.
12325	Average of all the above sizes.

So minute are these corpuscles, that vast numbers of them measure no more over the flat surface of the disc than the edge or thickness of the red corpuscle of human blood, the average of which appears from my measurements to be $\frac{1}{12400}$th of an inch.

The size of the blood-corpuscles in the ruminants affords a good illustration of the law, which I have elsewhere deduced from very numerous measurements, that in the smallest species of a natural order or family of mammals the blood-discs are much more minute than in

the largest species of that family; while in the entire class of Birds, the law as to the size of the blood-corpuscles is the same as in a single order of mammals.

Therefore, when that eminent inquirer Hewson states that these corpuscles are not larger in the largest animals, citing in support of his argument the Ox and Mouse, it must be understood as applicable only to mammals of different orders. Among the rodents which I have examined, the great species, as the Capybara and the Beaver, have much larger blood-corpuscles than the smallest species, as the Bank Vole and the Harvest Mouse.

2. Characters of Six new Genera of Bats not hitherto distinguished. By J. E. Gray, Esq., F.R.S. etc.

The first four genera belong to the tribe of *Phyllostomina*, or Nose-leafed Bats.

1. Mimon.

Ch. gen.—*Membrana interfemoralis* magna, truncata. *Alæ* latæ, margine anteriore lato, a summo talo extenso. *Pedes* elongati. *Crura* nuda. *Cauda* mediocris, inclusa; apice superiore, mediano. *Aures* laterales, magnæ. *Mentum* tuberculo parvo utrinque signatum; tuberculis striâ angustâ divisis. *Pollex* longus, attenuatus; articulis æqualibus. *Dentes* incisores $\frac{4}{2}$; duo medii superiores magni; inferiores parvi, stipati.

Ch. gen.—Interfemoral membrane large, truncated. Wings broad, with a broad front margin from the upper part of the ankle. Feet elongated. Legs bald. Tail moderate, enclosed; apex superior, medial. Ears lateral, large. Chin with a small tubercle on each side, separated by a narrow groove. Thumb long, slender; joints equal. Cutting teeth $\frac{4}{2}$; two middle upper large; lower small and crowded.

In the collection at the British Museum there are two species of this genus, viz. 1. *M. Bennettii* = *Phyllostoma Bennettii*, Gray, Mag. Zool. and Bot. vol. ii. p. 6; and 2. *M. megalotis* = *Phyllophora megalotis*, Gray, Ann. and Mag. N. H. 1842, p. 257; Voy. Sulphur, t. v. fig. 2.

2. Trachops.

Ch. gen.—*Membrana interfemoralis* magna, truncata. *Alæ* a summo talo extensæ. *Pedes* osse calcis elongato insignes. *Crura* nuda. *Cauda* mediocris, inclusa; apice superiore, mediano. *Aures* permagnæ, laterales. *Mentum* et *labia* verrucosa, stria lævis angusta in medio mento. *Dentes* incisores $\frac{4}{4}$; medii superiores magni, lati, incisi; inferiores irregulariter ordinati.

Ch. gen.—Interfemoral membrane large, truncated. Wings from the upper part of the ankles. Feet with the heel-bone elongate. Legs bald. Tail moderate, enclosed; apex superior, medial. Ears very large, lateral. Chin and lips covered with warts; chin with a narrow smooth groove in front. Cutting teeth $\frac{4}{4}$; middle upper large, broad, notched; lower in an irregular series.

Type, *T. fuliginosus*.

This species is characterized by its sooty-black colour. My son-in-law, Mr. J. P. G. Smith, collected it at Pernambuco, and sent two females to the Brit. Mus.

Vampyris cirrhosum, Spix, Vesp. Braz. t. xxvi. f. 3, evidently belongs to the same genus, if indeed it is distinct from the species above noticed. He describes his specimen as chestnut. It is to be observed that his figure is only one-third of the natural size of the animal he described, although it is not noticed on the plate.

3. Ametrida.

Ch. gen.—*Membrana interfemoralis* sublata, truncata. *Alæ* a digitorum basi extensæ. *Crura* nuda. *Caput* rotundum, rostrum perbreve, depressum, latum; frons rotundata. *Mentum* triangulari tuberculorum mole scabrum. *Pollex* elongatus, articulo superiore longo, attenuato, inferiore brevi. *Dentes* incisores $\frac{4}{4}$; superiores medii, elongati, conici, acuti; inferiores laterales, parvi, incisi.

Ch. gen.—Interfemoral membrane rather broad, truncated. Wings from the base of the toes. Legs bald. Feet small. Tail none. Head round; muzzle very short, depressed, broad; forehead rounded. Ears moderate, lateral. Chin with a triangular group of tubercles in front. Thumb elongated, the upper joint long, slender; the lower short. Cutting teeth $\frac{4}{4}$; the upper middle elongated, conical, acute; lateral and lower small, notched.

A. centurio, Epauletted Ametrida.

Ch. sp.—Sooty-brown; forehead, chin, and a spot on each shoulder at the base of the wing white. Heel-bone one-third the length of the shin. Arm-bones 11 lines. Ears moderate, rounded at the end, rather arched out at the sides. Tragus moderate, denticulate at the tip and outer side. Nose-leaf ovate, lanceolate.

Hab. Brazils, Para. Collected by Mr. J. P. G. Smith.

4. Nicon.

Ch. gen.—*Membrana interfemoralis* distincta, brevis, angulariter insecata. *Alæ* ab summo talo tensæ. *Pedes* elongati, liberi. *Os calcis* brevis. *Cauda* perbrevis, inclusa, in mediâ membranâ interfemorali superior. *Mentum* striâ tuberculis parvis marginatâ insigne. *Pollex* elongatus; articulo superiore attenuato, inferiore incluso. *Dentes* incisores $\frac{4}{4}$; duo medii superiores largiores, truncati; inferiores seriatim fornicati.

Ch. gen.—Interfemoral membrane distinct, short, angularly cut out. Wings from the upper part of the ankle. Feet elongate, free. Heel-bone short. Tail very short, enclosed, superior in the middle of the interfemoral. Ears lateral. Chin with a groove in front, edged with small tubercles. Thumb elongate; upper joint thin, longest; lower enclosed. Cutting teeth $\frac{4}{4}$; two middle upper larger, truncate; lower in an arched continuous series.

N. caudifer, Leach's Nicon = *Glossophaga caudifer*, Geoff. Mem. Mus. iv. 418. t. 17 = *Monophyllus Leachii*, Gray, Zool. Sulph. 18.

Hab. Central America.

The two following belong to the tribe of Horse-shoe Bats, *Rhinolophina* :—

5. Aquias.

Ch. gen.—*Prosthema* permagnum, complicatum, parte posteriore lanceolatâ erectâ, tribus magnis cellis utrinque; processus centralis compressus margine anteriore lato, expanso, foliaceo, lobato, medio basi convexo; ferrum equinum anterius magnum simplex expansum, centro inciso, setosum; labium inferius duabus verrucis triangularibus in medio notatum. *Mammæ* in pube distinctæ. *Alæ* a digitorum basi.

Nose-leaf very large, complicated; hinder part lanceolate, erect, with three large cells on each side in front; central process compressed, with an expanded broad foliaceous lobed front margin, and with a convexity in the front of its base edge, formed by a diverging ring on each side in front. The front horse-shoe large, simple, expanded, nicked in the centre, very hairy; lower lip with two triangular warts in the centre. Pubal teats distinct. Wings from the base of the toes.

This genus may be divided into two sections :—

1. The interfemoral acutely produced; tail as long as the shin and foot. *Rhinolophus luctus*, Temm.
2. Interfemoral truncate; tail as long as shin. *R. trifoliatus*, Temm.

We have a specimen in spirit in the Brit. Mus., which differs from Temminck's description of *Rh. luctus* in several particulars, but these differences may arise from his description having been taken from a dry specimen.

6. Rhinonicteris.

Ch. gen.—*Prosthema* breve, erectum, cellâ utrinque, et alterâ anteriore in medio basi; processus centralis compressus, anterius planus; ferrum equinum emarginatum, concavum; inter nares culmen fimbriatum. *Aures* magnæ. *Alæ* a talo. *Dentes* incisores $\frac{4}{4}$ incisi; superiores distincti; labium inferius triangulari tuberculorum mole scabrum.

Nose-leaf short, conical, erect, with a cell on each side and one in the centre of the front of its base; the central process compressed, flattened in front, and without any pit beneath; the horseshoe deeply nicked, concave, with a longitudinal anterior fringed ridge, ending in a pit behind, between the nostrils, and with a ridge over the nostrils on each side. Ears large, separate. Tragus none. Pubes ——. Wings from the ankle. Cutting teeth $\frac{4}{4}$, notched; upper distinct; lower lip with a triangular group of small warts in front.

Type, *Rh. aurantius* = *Rhinolophus aurantius*, Gray; Eyre's Central Australia, i. 406. t. 1. fig. 1.

Hab. Port Essington.

3. Drafts for an arrangement of the Trochilidæ or Humming-Birds. By J. Gould, Esq., F.R.S. (continued.)

Genus Eriopus.

Gen. char.—Bill straight, moderately long; tail slightly forked;

tarsi thickly clothed with downy feathers, forming a thick ruff round the leg.

Sexes nearly alike in colour.

Type, *E. vestita.*

I beg to propose the above generic appellation for a section of this family, comprising those species distinguished by the extraordinary ruffs of downy feathers with which their tarsi are clothed, and by the sexes being nearly alike in the colour of their plumage. All the species known frequent the mountain districts of the Cordillerian Andes or the valleys immediately beneath them.

I possess five species of this form, and I have seen two others in the collection of Mr. Loddiges, which I believe to be equally typical.

Sp. 1. Eriopus vestitus.

Ornismya vestita, Gouy de Longuemare; Less. in Rev. Zool. 1838, p. 314; Boiss. Rev. Zool. 1839, p. 18, 1840, p. 8; Mag. de Zool. pl. —— ?

T. uropygialis, Fras. Proc. of Zool. Soc. 1840, p. 15.

O. glomata, Less. Echo du monde savant, young?

Sp. 2. Eriopus cupreoventris.

Trochilus cupreoventris, Fras. in Proc. of Zool. Soc. 1840, p. 14.

Ornismya maniculata, Less. Echo du monde savant.

Ornismya vestita ♀, Gouy de Long. Rev. Zool. 1838, p. 314.

Ornismya glomata, Less. Echo du monde savant, young?

Sp. 3. Eriopus Alinæ.

Ornismya Aline, Bourc. Rev. Zool. 1842, p. 373; Ann. de Lyons, tom. v. 1842, p. 344. pl. xix.

Sp. 4. Eriopus mosquera.

T. mosquera, Bourc. et Delatt. Rev. Zool. 1846, p. 306.

Sp. 5. Eriopus Derbyi.

T. Derbyi, Bourc. et Delatt. Rev. Zool. 1846, p. 306.

This group forms part of M. Lesson's *Race Vestipedes,* the genera comprised in which have not as yet I believe been defined.

4. An account of Palolo, a Sea Worm eaten in the Navigator Islands. By the Rev. J. B. Stair, with a description by J. E. Gray, Esq., F.R.S. etc.

The Rev. J. B. Stair kindly presented numerous specimens of this Sea Worm to the British Museum, but unfortunately most of the specimens are broken into short pieces, and as yet I have not been able to discover any specimen with a head. It appears to be a new genus allied to *Arenicola,* which may be thus described:—

Palola, Gray.

Body cylindrical, separated into equal joints, each joint with a small tuft of three or four spicula on the middle of each side. Head —— ? Last joint ending in a couple of tentacles. Eggs globular.

Palola viridis, n. s.

Green, with a row of round black spots down the middle of the dorsal? surface; one spot on the middle of each joint.

Hab. Navigator Islands.

I have found accompanying this worm a single specimen of a green *Nereis*, which differs from it in being paler green above and whitish beneath, shorter, more depressed, and furnished with white tentacles.

The following is the account which Mr. Stair kindly communicated to me with the specimen from Samoa:—

"*Palolo.*—Palolo is the native name for a species of Sea Worm which is found in some parts of Samoa (the Navigator Islands) in the South Pacific Ocean. They come regularly in the months of October and November, during portions of two days in each month, viz. the day before and the day on which the moon is in her last quarter.

"They appear in much greater numbers on the second than on the first day of their rising, and are only observed for two or three hours in the early part of each morning of their appearance. At the first dawn of day they may be felt by the hand swimming on the surface of the water; and as the day advances their numbers increase, so that by the time the sun has risen, thousands may be observed in a very small space, sporting merrily during their short visit to the surface of the ocean. On the second day they appear at the same time and in a similar manner, but in such countless myriads that the surface of the ocean is covered with them for a considerable extent. On each day, after sporting for an hour or two, they disappear until the next season, and not one is ever observed during the intervening time. Sometimes, when plentiful at one island in one month, scarcely any are observed the next; but they always appear with great regularity at the times mentioned, and these are the only times at which they are observed throughout the whole year. They are found only in certain parts of the islands, generally near the openings of the reefs on portions of the coast on which much fresh water is found, but this is not always the case.

"In size they may be compared to a very fine straw, and are of various colours and lengths, green, brown, white and speckled, and in appearance and mode of swimming resemble very small snakes.

"They are exceedingly brittle, and if broken into many pieces, each piece swims off as though it were an entire worm. No particular direction appeared to be taken by them in swimming. I observed carefully to see whether they came from seaward or rose from the reef, and feel assured they come from the latter place.

"The natives are exceedingly fond of them, and calculate with great exactness the time of their appearance, which is looked forward to with great interest. The worms are caught in small baskets, beautifully made, and when taken on shore are tied up in leaves in small bundles, and baked. Great quantities are eaten undressed, but either dressed or undressed are esteemed a great delicacy. Such is the desire to eat Palolo by all classes, that immediately the fishing parties reach the shore, messengers are despatched in all directions with large quantities to parts of the island on which none appear.

"JOHN B. STAIR."

5. Notes on certain Molluscous Animals. By Arthur Adams, Esq., R.N., Assistant Surgeon to H.M.S. Samarang.

The following notices refer to the animals that construct the shells of *Pyrula, Calpurnus, Radius, Terebellum, Rostellaria, Eulima, Stilifer* and some others, which I believe have not before been described, though the shells have long been known. The drawings were made from the living mollusks on the spot.

The genus *Bullina* of Risso or *Cylindrella* of Swainson has an external subcylindrical shell covered with a thin reddish-brown epidermis. The mantle is enclosed; the foot elongate, linear, truncated, and with three conical tubercles behind. The cephalic disc is subtrigonal, broad, rounded in front, and produced behind on each side into a flat tapering process, with the eyes on the outer side of its base. They crawl very slowly, moving by an almost imperceptible series of undulations of the foot. Dredged in fifteen fathoms, between Borneo and Billiton. Mr. Gray informs me that M. Lovèn has recently described the animal of a northern species of this genus under the generic name of *Cylichna*.

The animal of *Akera*, Müller, *Vitrella* of Swainson, or the *Bulla resiliens*, is pale brown, with the foot very much expanded, narrower and rounded in front, broad and truncated behind, and with the sides sometimes bent up. The head-disc is elongated, rather broader, and slightly notched in front, but narrower and linear behind. Eyes none. The shell is perfectly external, and there is a fimbriated edge projecting through the slit in the spire. From Unsang, Borneo.

This animal agrees with Lovèn's description of the northern species. Müller figures the animal of *Akera bullata*, a northern species of this genus, in the 'Zoologia Danica'; and M. Lovèn in his recent work has observed, that Müller's species emits through the slit in the back of the whorls a series of elongated slender beards, which are appended to the mantle's edge.

The mollusk that constructs the shell of *Bulla smaragdina* would appear to form the type of a new genus. The shell is naked above. The foot moderate, rounded before and behind; the side-edges reflexed and covering the sides of the shell. The head-disc is five-sided, rather broader on each side in front, flattish above with two small tubercles in front of the central eyes, and narrower and nicked behind. It is amphibious, though entirely marine, crawling slowly on rocks immediately above the ripple of the sea. The eyes are black and sessile; the tentacula short and anterior to the eyes. The animal is dark olive-green, with the margin of the foot and mantle of a light colour, and mottled and speckled. Cagiani Islands and Disaster Island near Japan.

In *Calpurnus* of De Montfort the mantle adheres to the sides, but does not cover the shell. It is dead-white and covered with round black spots. The foot is large, thin, flat, expanded, and marked like the mantle. The tentacula are tapering with a broad black band near their extremities. The eyes are large and black, and are placed

at the outer base of the tentacles. The longest slope and narrowest end is the forepart of the shell.

Taken alive at the southern extremity of Mindoro, not far from Ylin: in shallow water and on a sandy bottom.

In *Radius* or *Ovulum Volva* the mantle is covered with nipple-shaped tubercles, the nipples and areolæ of which are dark-coloured. The tubercles extend to the extremities of the beaks of the shell. The foot is moderate and folded longitudinally. The tentacles are elongate and subulate. Dredged in five fathoms from a rocky coral bottom on the shores of Basilan.

The *Radius* is slow and languid in its movements, sliding along deliberately, and not more sensible to alarm than *Cypræa* or *Calpurnus*.

In the genus *Pyrula*, Lamk. (*Ficula* of Swainson), the siphon is elongate, subcylindrical, and produced in front. The head slender; the tentacles subulate, on the side of the extremity of the head, and separate from one another at their bases. Eyes sessile on the outer side of the base of the tentacles. The mantle is produced on each side into a rounded lobe equally reflexed on each side of the shell. The foot is very large and expanded; rounded in front, and rather produced on each side of the anterior margin, and expanded and broad with a small central point behind. There is no operculum. The head is marbled with light violet and the tentacles white. Six white opake spots are arranged round the upper surface of the edge of the foot. There is another very beautiful species of *Ficula* with a pink mantle, mottled with white and deeper pink, the under surface of the foot dark chocolate-colour with sparse yellow spots. The first-mentioned species is from the west coast of Borneo, from seventeen fathoms, muddy bottom, and the latter from thirty-five fathoms in the sea of Mindoro.

Mr. Gray has observed that Lamarck established his genus *Pyrula* on this species, *Bulla ficus*, Linn., therefore the generic name should be retained for this form of animals, which he regards as an intermediate link between *Muricidæ* and *Cypræidæ*.

The animals of *Ancillaria* crawl with a sliding motion and with considerable celerity. The specimens we found on the east coast of Africa were of a dirty white colour with dull brown blotches. When alarmed, the entire animal is retracted within the shell.

The genus *Marginella* has an elongated slender tapering siphon, with the tentacles also elongate and slender, bearing the eyes at their outer side just above the base. The foot is large, broad, truncated in front, rather acute behind, and extends beyond the shell on all sides. The mantle is thickened, and reflexed partly over the entire circumference of the shell. The animal, when roughly handled, retracted itself entirely into the shell. Dredged up in three fathoms water, sandy bottom, not far from Anger in Java.

A second species from the east coast of Africa is similar to the former, but the foot is rather more expanded and more rounded behind. The left side of the mantle is rather more produced over the

back of the shell than the right. The end of the tentacula and siphon in this species is yellow and the basal part streaked with carmine. The foot and mantle are semi-transparent flesh-colour, streaked with deep carmine.

These *Marginellæ* are quicker and more lively in their movements than *Cypræa*, crawling pretty briskly and moving their tentacles in various directions.

The head of *Eulima* is small; the tentacles are subulate, close together at the base, rather thicker at that part, and slender beyond. The eyes are placed on the back of the head behind the base of the tentacles. The foot is rather expanded, rounded and somewhat produced on each side in front, and rounded in behind. Operculum ovate, subspiral. The animal is entirely opake pearly white. The eyes black and generally concealed under the front of the shell. Tentacles yellow at the tip, orange in the middle, and white at the base.

Mr. Gray states that he places this genus with the family *Pyramidellidæ* in his arrangement, and it chiefly differs from *Pyramidella* in having no plaits on the pillar-lip. It is a slow and excessively timid animal. From eight fathoms water; Philippines.

The tentacula of the more elongated species of *Melania* are subulate, close together at the base, with the eyes on short peduncles on the outer side of the base. The trunk is oblong, expanded and annulated, with a central cylindrical groove. The foot is expanded, rather produced and acute behind, with the operculum on the front of the upper surface. Operculum orbicular and many-whorled. They are generally found partially buried in the ooze formed by decayed vegetable matter where weeds abound, and where the water is verging towards stagnation.

The animal of *Turritella* is rather small for the size of the aperture of the shell; the head is small and oblong; the tentacula short and subulate, with the eyes on the middle of their outer side. The foot is moderate and slightly notched in front. Operculum orbicular, horny, many-whorled, with an epidermic fimbriated margin.

This mollusk is very shy and sensitive, retiring quickly within its shell on the slightest alarm. It is slow-moving and inactive.

The tentacula of *Pleurotoma* are subulate and close together at the base, and the eyes are near the outer side of the tip, which latter tapers off beyond them. They generally inhabit pretty deep water and crawl tolerably fast.

Fusus, Lam., has an elongated subcylindrical siphon, with subulate tentacles close together at the base, and becoming more slender beyond the eyes. Eyes placed rather above the middle of the outer side. Foot moderate. Operculum annular, oblong.

The *Cerithium truncatum* has a broad suborbicular and expanded foot, and an elongated subcylindrical annulated trunk. The tentacula are short with the eyes at the tip. It is found generally in brackish water in mangrove swamps and the mouths of rivers. Sometimes they crawl on the stones and leaves in the neighbourhood, and sometimes they are found suspended by glutinous threads to boughs

and the roots of the mangroves. Mr. Gray (vide Proc. Z. S. 1833, p. 112) states he has found the *Rissoa* similarly suspended. From the swamps of Singapore and banks of rivers in Borneo.

The animals of *Quoyia* are amphibious like *Conovuli*, being found in the shallow water at the roots of the mangroves or adhering to stones not far inland, but exposed to the sun. They are fond of those little bays where the water is shallow and the ripple gentle.

In *Phorus* the separation from the foot is by a large space produced into a subcylindrical annulated trunk. The tentacles are tapering and elongate, with the eyes sessile on the outside of their base. The foot is small and divided into two parts, the front rather expanded, the hind part small and tapering, carrying a large operculum. Operculum ovate, subannular? Penis elongate fusiform from the right side, rather below the base of the tentacula. These animals are small for the size of the mouth of the shell, and have much the general appearance of the animal of *Strombus*, like which they appear to walk, but their eyes are sessile. In colour they are dull opake white, the proboscis pinkish and the eyes black. They crawl like a tortoise by lifting and throwing forward the shell with the tentacles stretched out, the proboscis bent down and the operculum trailing behind. They are numerous in the Javan and China seas, preferring deep water, and a bottom composed of detritus of dead shells and sand mixed with mud.

This genus has been generally placed with the *Trochi*, and some have proposed to remove it to near *Calyptræa*; but Mr. Gray, in his systematic arrangement of the genera of mollusca published in the Synopsis to the British Museum (1840), p. 119, formed for this genus a peculiar family under the name of *Phoridæ*, having observed that the animal, though a *Phytophagous* mollusk, had the annular operculum of the *zoophagous* division.

The animal of *Terebellum* has an annulated elongate proboscis with a central groove. The eyes are on the end of long cylindrical peduncles, one placed on each side of the base of the trunk and unequal in length and origin. The body is thick and short; the foot ovate, broad, rounded in front and tapering behind. Operculum triangular, small, and serrated on the outer side with a great part free. This genus is on the confines of the family of *Strombidæ*, where Mr. Gray first proposed to place it (see Synopsis, British Museum, 1841, p. 84, and 1842, pp. 52 and 89), for it agrees with the animal of that group in having the eyes placed at the ends of elongated peduncles, and in having the operculum triangular and serrated on the outer edge; but it differs from them in having no tentacula arising from the upper part of the peduncle beneath the eyes, and in having a thicker body and a broader and flatter foot.

One specimen, from which I made a sketch, was taken in the Javan sea, the other is from the Caramata Passage.

The animal is exceedingly shy and timid, retracting its body into the shell on the slightest alarm. It will remain stationary for a long time, moving its tentacula about cautiously in every direction, when suddenly it will roll over its shell and continue again perfectly quiet.

With regard to *Rostellaria rectirostris*, or more properly *recti-rostrata*, I have a few words to say before I conclude this somewhat desultory communication.

The animal of this genus is exactly like that of *Strombus*. The body is subcylindrical, marbled with rich brown on the outer side, and white on the inner and front side. The trunk is subcylindrical, and annulated with a central broad line of deep bronze-black. The margins yellow with a narrow vermilion line externally. The eyes are on long cylindrical peduncles, of a deep blue with a black pupil. The tentacula are subulate, elongate, arising from the peduncle rather below the eye. The foot is narrow, rather dilated in front and small behind. The operculum is ovate, triangular, annular, semi-transparent and horny. Living in black muddy sand in thirty-one and a half fathoms water. The specimen I figured was dredged on the coast of Borneo.

Rostellaria has all the habits of the *Strombidæ*, progressing by means of its powerful and elastic foot, which it places under the shell in a bent position, when suddenly by a muscular effort it straightens that organ and rolls and leaps over and over. It is however far more timid and suspicious than *Strombus*, which has a bold disposition.

The animal of the genus *Stilifer*, which I found living on the body of a starfish (*Asterias*) on the coast of Borneo, had two elongate subulate tentacles, with the eyes sessile near the outer side of their base, and a small rounded head. The mantle is entirely enclosed and covered by the thin shell, and the foot is narrow, slender, very much produced beyond the head in front and scarcely extended at all behind.

The animal of this genus was described and figured in Mr. Sowerby's 'Genera of Shells' from a specimen in spirits brought home by Mr. Cuming, where the fleshy part enveloping the shell in its contracted state was considered as the mantle.

Mr. Gray, in the Synopsis before referred to (ed. 1842, p. 60), from the examination of these figures, placed the genus in the family of *Naticidæ*, and observes that "what has been called the enlarged mantle appears like the foot;" and the above description of the animal shows the accuracy of Mr. Gray's conclusion, both as to the proper nature of the fleshy part and the position of the genus in the system.

In the shallow pools left by the receding tide on the shore of Koo-Kian-San, one of the Maiacoshima group of islands, I discovered a large species of *Dorididæ*, which appears to be the type of a new genus, differing from all the other genera of the family in having the vent, and the gills which are extruded from it, situated beneath the edge of the mantle, which latter is extended beyond the circumference of the foot, while in all the other genera, as far as I am aware of, the vent and gills are situated on the mantle itself. This genus may be called HYPOBRANCHIÆA*.

* ὑπὸ (*sub*), βραγχίεια (*branchiis prædita*). The specific name might be "depressa," from its flattened appearance.

Ch. gen.—Brachiis ano circumdatis, sub posteriore pallii margine positis. Pallio lato, ultra pedem extenso; duobus tentaculis claviformibus; corpore depresso.

The animal (*Hypobranchiæa fusca*) was of a sandy colour, the central disc deeper, with oblong blotches of a dark brown colour. In length about six inches, and in breadth two and a half. The under surface was light chocolate-colour, and the tentacula reddish brown. It crawled upon its flattened ventral disc in a slow and languid manner, and when detached and thrown into deeper water floated some time by undulating the free thin edges of the mantle, and gradually sunk to the bottom.

6. Descriptions of new Species of Shells collected in the Eastern Archipelago by Capt. Sir Edward Belcher and Mr. Adams during the Voyage of H.M.S. Samarang. By Lovell Reeve, F.L.S.

Chiton coreanicus. *Chit. testâ ovatâ, elevatiusculâ, valvis terminalibus cæterarum areisque lateralibus radiatim sulcatis, interstitiis convexis peculiariter granatis, granis prominentibus, rotundatis, solitariis, valvâ terminali posticâ umbonatâ, extremitate radiatâ parvâ, brevi; areis centralibus longitudinaliter tenuissimè granato-liratis, lirarum interstitiis excavatis; areïs lateralibus nigricante-viridibus, granis lutescentibus, areis centralibus lutescentibus nigro variè maculatis et variegatis; ligamento tenuiter granoso-coriaceo, nigricante-viridi et virescente concinnè tessellato.*

Long. $1\frac{5}{8}$ poll.; lat. 1 poll.

Hab. Korean Archipelago, under stones.

The sculpture of this species is not much unlike that of the *C. luridus*; still it is distinct, and accompanied with a very characteristic style of painting. The central areas of the shell are of a yellowish ground, blotched and variegated with black. The terminal and lateral areas are very dark green, with the prominent granules conspicuously tinged here and there with yellow. In addition to these peculiarities, the ligament is strikingly tessellated with dark and pale sea-green.

Chiton fuliginatus. *Chit. testâ oblongâ, valdè elevatâ, valvis terminalibus cæterarum areisque lateralibus subirregulariter concentricè striatis, prope marginem incisis, areis centralibus lævibus, sub lente minutissimè reticulatis; sordidè albâ, nigro plus minusve sparsim fuliginatâ; ligamento corneo, angusto, fusco.*

Long. $\frac{5}{8}$ poll.; lat. $\frac{5}{16}$ poll.

Hab. Korean Archipelago.

The terminal and lateral areas, the latter of which are so slightly raised as to be nearly on a plane with the rest of the shell, are striated concentrically, the striæ next the margin being somewhat deeply engraved. Of numerous specimens collected at the above-mentioned islands, all are of an uniform dull white, more or less sparingly besooted with black.

Chiton acutirostratus. *Chit. testâ elongatâ, medio elevatâ, lateraliter subcompressâ, valvis summitate obtuso-carinatis, lævibus, utrinque creberrimè planigranatis, umbonibus productis, acutè rostratis, valvarum areis lateralibus parvis, subindistinctis, concavis; albidâ, summitate nigro hic illic inquinatâ; ligamento corneo, spicularum cristâ parvâ ad latus utriusque valvæ munito.*

Long. $1\frac{1}{8}$ poll.; lat. $\frac{1}{2}$ poll.

Hab. Cape Rivers.

An elongated species, of somewhat angularly compressed growth, remarkably distinguished by the sharply beaked structure of the umbones; the flatly-grained sculpture of the valves approaches that of *C. hirudiniformis*, to which it offers a singular contrast of colour.

Chiton petasus. *Chit. testâ parvâ, subabbreviato-ovatâ, valvis medio areâ trigonâ subrostratâ politâ, utrinque rugoso-granatis; vividè coccineâ; ligamento latissimo, præcipuè anticè, quoque vividè coccineo, setis pilisve brevibus hic illic obsito.*

Long. 1 poll.; lat. $\frac{3}{4}$ poll.

Hab. Cape Rivers.

A beautiful little bright scarlet shell enframed within a broad swollen ligament of the same very striking colour; in the form of the ligament it is the nearest approach I have seen to that remarkable species the *C. Blainvillii.*

Chiton formosus. *Chit. testâ oblongâ, subangustâ, valvis undique subtilissimè longitudinaliter striatis; vividè coccineâ; ligamento corneo, spiculis vitreis nitidè albis densè obsito, spicularum cristâ densâ erectâ ad latus utriusque valvæ.*

Long. $\frac{1}{2}$ poll.; lat. $\frac{3}{16}$ poll.

Hab. Cape Rivers.

A most exquisite little species of a bright scarlet colour, surrounded with dense tufts of white shining glassy spiculæ. Of this and the two preceding species only a single specimen of each was obtained.

Cardium Bechei. *Card. testâ subcordato-ovatâ, medio et anticè lævigatâ, striis minutis superficiariis radiantibus et concentricis sub lente decussatâ, epidermide tenui corneâ nitente in funiculis fibrisve concentricis creberrimè dispositâ; areâ posticâ, epidermide nullâ, radiatim costatâ, costis tenuibus, confertis, quinque et viginti ad triginta, spinis brevibus compressis densissimè seriatim ornatis; undique pulcherrimè roseâ, intus albâ.*

Alt. 2 poll.; lat. $1\frac{7}{8}$ poll.

Hab. Sooloo Seas and Korean Archipelago.

I have much pleasure in dedicating this species, at the desire of Capt. Sir Edward Belcher, to Sir Henry De la Beche, Director of the Ordnance Survey and President of the Geological Society. It forms a most interesting addition to the genus *Cardium*, and is without exception the most striking and distinct from any hitherto known that can well be imagined. In colour it is of a pure rose tint, with the following singular contrast of character. The middle and anterior portion of the shell is smooth, presenting a peculiar soft velvety

appearance, the effect of its being minutely decussated with concentric and radiating striæ, and covered with an exquisite thin shining horny epidermis, disposed in fine concentric cords, abruptly terminating at the posterior area. The posterior portion, accordingly destitute of epidermis, is very thickly rayed with ribs of short compressed spines, as if the delicately clad surface of the shell had been thus far ploughed up, as it were, into furrows.

Only two odd valves of this pre-eminently beautiful shell were obtained, and, singularly, in localities very remote from each other; one was dredged at the depth of forty fathoms in the Sooloo Seas, between the islands of Borneo and Mindanao; the other in the Yellow Sea, thirty degrees north, at one of the islands of the Korean Archipelago.

March 23.—William Yarrell, Esq., Vice-President, in the Chair.

The following communications were read:—

1. Note on the Breeding of the Otter in confinement in the Zoological Gardens, Regent's Park, in 1846. By James Hunt, Head Keeper.

The female Otter was presented to the Society by Lady Rolle on the 4th of February 1840, being apparently at that time about three months old. She remained without a male till the 11th of March 1846, when a large male was presented to the Society by the Rev. P. M. Brunwin, of Braintree, Essex, in whose possession it had been for some months, and had been kept in a cellar. His weight when first taken was 21 lbs., but he was not above half that weight when he arrived at the Gardens, having wasted much in confinement and become very weak in the loins, from which he soon recovered after his arrival. About a month after his arrival there was a continual chattering between him and the female during the night, which lasted for four or five nights; but they did not appear to be quarrelling. Nothing further was observed in their manners or in the appearance of the female to make me think she was with young, until the morning of the 13th of August, when the keeper that has the charge of them went to give them a fresh bed, which he does once a week; while in the act of pulling out the old bed he observed two young ones, apparently five or six days old, and about the size of a full-grown rat: he immediately put back the bed, with the young on it, and left them. On the 21st the mother removed them to the second sleeping-den, at the other end of their enclosure, and several times after she was observed to remove them from one end of the house to the other, by pushing them before her on a little straw; her object in removing them appeared to be to let them have a dry bed: on the 9th of September they were first seen out of the house; they did not go into the water, but crawled about, and appeared very feeble.

On the 26th of September they were first seen to eat fish, and follow the mother into the water: they did not dive into the water like the mother, but went into it like a dog, with their head above water; and it was not until the middle of October that they were

observed to plunge into the water like the old ones. On the 22nd of December the water was let out of the pond for the purpose of cleaning it, which is done once a week: the animals were shut up in their sleeping-den, but they let themselves out when the pond was but half-full of water, and the young ones got into it and were not able to get out without assistance; after they had been in the water some minutes the mother appeared very anxious to get them out, and made several attempts to reach them from the side of the pond where she was standing; but this she was not able to do, as they were not within her reach. After making several attempts in this manner without success, she plunged into the water to them, and began to play with one of them for a short time, and put her head close to its ears, as if she was making it understand what she meant; the next moment she made a spring out of the pond, with the young one holding on by the fur at the root of the tail with its teeth; having safely landed it, she got the other out in the same manner: this she did several times during a quarter of an hour, as the young ones kept going into the water as fast as she got them out. Sometimes the young held on by the fur at her sides, at others by that at the tail. As soon as there was sufficient water for her to reach them from the side of the pond, she took hold of them by the ears with her mouth and drew them out of the pond, and led them round the pond close to the fence, and kept chattering to them, as if she was telling them not to go into the pond again.

2. Notes in addition to former (Zool. Proc. 1843, p. 108, and 1846, p. 9) Papers on South American Ornithology. By T. Bridges, Esq., Corr. Memb.

The beautiful species of *Eudromia* mentioned in my letter to Mr. Waterhouse (Proc. for 1846, p. 9) proved to be the bird characterized by Mr. Vigors under the name of *Tinamotis Pentlandii* (Proc. 1836, p. 79). On September 15, 1845, I found three couple in the pass of Tapaquilcha, between the town of Calama and the city of Potosi: they were close to the snow, at an altitude of about 14,000 feet, with the *Pepoazæ*, skulking among the isolated stones which not unfrequently occur in grassy places in the valleys of the main chain of the Andes. When they rise they utter a shrill and loud whistle, and fly a mile perhaps, getting up rapidly and shooting off in a horizontal direction.

About twenty miles further on the road I stopped at a post-house, and there the natives brought a fresh-laid egg, which they said was the egg of this species. There could be no doubt about it, as I was engaged at the time in skinning one of the three specimens we had obtained. It was light green, larger than a lapwing's, and very obtuse at each end. It had none of that polished texture which is so characteristic in the Tinamous. I regret that it was accidentally broken.

Although I sought for this bird in many similar situations throughout Bolivia, I never again succeeded in finding it.

Tinamotis elegans; *Eudromia elegans*, D'Orb. & Geoff. Mag. de Zool. 1832, t. 1.

I met with this species on the eastern side of the Andes—I believe it never occurs on the Chilian side—in the vicinity of the city of Mendoza, in the Argentine Republic. It has an immense range over the grassy plains at the base of the Andes which run southward to Patagonia. I believe it generally is found in pairs; at least the only two I ever saw alive were together. My men informed me that it is abundant on the Pampas, near the forts of San Raphael and San Carlos, between 33° and 34° south lat.* The young bird presents no difference in plumage from the adults, having even the crest well-developed: it seems therefore to form an exception to the generally received rule, that where the parent birds have the same plumage the young is different from either.

The Indians have a singular method of taking this bird. Having attached a noose to the end of a cane four or five yards long, they walk round and round in gradually contracting circles, until they are near enough to slip the noose over its head, and then, with a sudden jerk, they strangle it.

Attagis Gayii, Geoff. et Lesson, Cent. Zool. t. 47.

I believe the Chilian and Bolivian species are identical. I found the bird on the same day as *Tinamotis Pentlandii*, inhabiting the margins of frozen brooks near the post-house of Tapaquilcha. The Indians there know it as the Puco-puco, from its call-note. Like *Thinocorus D'Orbignianus*, these birds evince great attachment to each other, and call immediately if separated. At that season they were in pairs and breeding, but I did not obtain the egg.

Diglossa carbonaria, D'Orb. & De Lafres.
Diglossa sittoides, D'Orb. et De Lafr.

Birds of this genus are found in the temperate region, where the thickets commence, at an altitude of from 8000 to 10,000 feet. I found these species among bushes of *Salvia* and *Eupatorium*, on the slopes which fall into the valley of Cochabamba, and most abundantly at a place called Ticquepaya. They have precisely the habits of flycatchers. *D. carbonaria* I have watched often, sitting motionless on the highest twig of a bush until he discovered a passing insect, on which he descended, and then returned to his post. I may mention that the vicinity of Cochabamba was the only district in which these two species occurred to me.

Diglossa mystacalis, De Lafr.; *Diglossa mystacea*, G. R. Gray in Gen. of Birds, pl. 42.

Lives entirely in the thickets, hopping from bough to bough, as if in pursuit of insects. I have often seen this species insert its bill into a scarlet and purple flower allied to the *Arbutus*, but whether for the purpose of capturing insects or of extracting honey I was not able to ascertain. Its habitat is the Yungas of La Paz.

* The specimens now in the British Museum were obtained from this locality, as well as those of *Rhea Darwinii*.

I believe that the specimen described by M. le Baron De Lafresnaye was from my collection.

Colaptes rupicola, D'Orb., is a Bolivian species, entirely terrestrial. I found it on the elevated table-land called the Punas, which form the departments of Potosi, Chuquisaca, Cochabamba, La Paz, and Oruro. They are occasionally intersected by valleys and isolated mountains, but the unbroken plains are sometimes several leagues in extent. You find *C. rupicola* at an altitude of 12,000 to 14,000 feet, and generally in the grass, where it feeds. On being disturbed it takes an undulating flight towards some rock, on which it settles, for this country is entirely destitute of trees. It most frequently occurs in little companies of five or six.

Another species of *Colaptes*, which frequents the warm plains of Moxas, near the town of Trinidad, not unfrequently resorts to the trees which there grow in forest patches, and in this particular it resembles *C. chilensis*.

The genus *Dendrocolaptes*, as far as I have had opportunities of observing their habits, exactly resemble the woodpeckers, ascending the trees and searching the bark in a similar manner, and even supporting themselves by the tail. In the plains between the Indian town of Loretto and Trinidad, about long. 62°, I found a beautiful instance of the modification of form to a particular end, in the apparently singular species

D. procurvus, D'Orb. & De Lafr.

As far as my experience goes, it only occurs in the open palm-groves which crown the undulating elevations which here and there rise up above the ordinary level of this district. In them I found a palm called Mutacu, with foliage like the date-palm. The short peduncles of the fallen leaves afford shelter to numerous coleoptera, and they grow from the trunk in a curve exactly similar to that which characterizes the bill of this species, so that as he runs up the trunk he is able to search all these lurking-places to the very bottom, although their form renders them impregnable to every other assailant.

In the dense forests, where this particular palm is never to be found, I observed an abundance of the other species, but *D. procurvus* not once.

3. Drafts for a new arrangement of the Trochilidæ. By John Gould, F.R.S. (continued from p. 409.)

The *Ornism. Sappho* of Lesson, and a nearly-allied species which I shall describe in the present paper, appear to differ in so many characters from all the genera of this family hitherto instituted, that I propose to place them in a distinct genus or subgenus, under the name of Cometes, with the following characters:—

Cometes, nov. gen.

Char. gen.—*Rostrum* capite longius, cylindraceum, decurvatum. *Cauda* valdè furcata, plumis latis, truncatis. *Tarsi* nudi. *Pedes* moderati. *Digitus* et *unguis* postici digito et ungue mediis breviores.

Gen. char.—Bill longer than the head, cylindrical, and curving downwards; tail much-forked, feathers broad and truncate; tarsi bare; feet moderately large; hind-toe and claw shorter than the middle toe and claw.

1. Cometes Sappho. *Ornism. Sappho*, Less., Ois. Mouch. t. 27, 28.

2. Cometes Phaon, sp. nov. *Com.* (Mas) *capite, collo, alarum tectricibus, et corpore inferiore, brunni-viridibus; dorso, caudæ tectricibus, caudâque, intensè fulgente coccineis; rectricibus ad basin nigro-fuscis, ad apicem holosericis atris; alis fuscis purpurascentibus; gulâ luminosè metallicè viridi.*

Male.—Head, neck, wing-coverts and under surface brownish green; back, upper tail-coverts and tail rich deep lustrous crimson; bases of the tail-feathers blackish brown; the tips deep velvety black; wings purplish brown; throat rich lustrous metallic green.

Female.—Tail of the same crimson colour as that of the male; she also possesses the lengthened and curved bill.

Total length, 7 inches; bill, $1\frac{1}{8}$; wing, $2\frac{3}{4}$; tail, 4.

This fine species is a native of Peru, and differs from the *Sappho*, which inhabits Bolivia, in having the tail rich crimson instead of flame-colour, and in having a much longer and more curved bill. The two specimens exhibited, which are male and female, have been kindly lent me, for the purpose of describing, by the Earl of Derby.

April 13.—William Yarrell, Esq., Vice-President, in the Chair.

The following communication was read:—

Description of a new species of Fuligula.
By A. D. Bartlett.

Fuligula ferinoides. *Fulig. ferinoides fuligulæ ferinæ similis, sed magnitudine minori, colore saturatiori, alis speculo albo conspicuè notatis, oculis stramineis, tracheâ paulò longiore et angustiore, et sterno multo minore, diversâ; emarginationes tamen sterni ejus iis ferinæ sterni magnitudine æquales.*

Paget's Pochard. Adult male: Upper part of head, neck and cheeks reddish chestnut, tinged with purple; a small triangular spot of white at the commencement of the feathers under the bill; chin, throat, lower part of neck and breast black, darkest on the breast; back, scapulars, flank and side-feathers finely freckled with transverse lines of black on a greyish-white ground; greater wing-coverts and primaries greyish-black, the latter darkest at the tips; secondaries white, forming the speculum; tips of the feathers black, edged with white; rump, tail, upper and under tail-coverts brownish black; belly mottled, the tips of the feathers being white, the remaining portion brownish; bill and legs bluish slate; the tip of the former and the webs and *claws* of the latter black; the eyes straw-colour. The young birds differ in having the head, neck and breast of a lighter and brighter chestnut-red (becoming darker as the bird advances to maturity); the under tail-coverts greyish-white.

Entire length, $17\frac{1}{2}$ inches; wing, from carpal joint, $7\frac{3}{4}$; bill, from forehead, $1\frac{3}{4}$; middle toe and claw, $2\frac{1}{2}$ inches.

I have proposed the above specific name for this bird, as it appears more closely allied to our common Pochard than to any other species. I have called it, at Mr. Fisher's suggestion, Paget's Pochard, after the late E. J. Paget, Esq., of Great Yarmouth, a gentleman well-known as a zealous and accomplished naturalist, and one of the authors of the 'Sketch of the Natural History of Great Yarmouth and its Neighbourhood,' near which place the first authenticated British specimen was obtained.

Remarks.—This bird may be readily distinguished from the common Pochard (which it most resembles) by its smaller size, darker colouring, the conspicuous *white speculum* on the wing, and the colour of the eyes. The female is unknown to me, but I presume it will much resemble the female of the Pochard, and will doubtless possess the white speculum on the wings.

The *trachea* of *F. ferinoides* differs from that of *F. ferina* in being rather longer and narrower, the tube being much narrower at the upper part, gradually enlarging towards the middle, where it is largest, and contracting gradually towards the end, which is its smallest part: the labyrinth is smaller in front, but much wider and differently formed on the left side; the enlargement at the bottom of the tympanum is also greater than that of the corresponding part in *F. ferina*: although the sternum is much smaller, the emarginations are quite equal in size to these parts in *ferina*.

With reference to the supposition that these birds are hybrids, I beg to remark, that I have paid some attention to the subject of hybrids, and have compiled a list of the different species of Water Fowl (as far as I have been able to collect) which have produced hybrids. On referring to this list it will be seen that nineteen different kinds are mentioned; five of these are referable to the *Common Goose*, and five of them to the *Common Duck*; the remaining nine kinds are referable to species commonly kept, and which breed freely in a state of captivity. I am unable to find one instance of any species of the genus *Fuligula* (which includes no less than 15 species) having under any circumstances crossed. These birds are most difficult to breed in a state of captivity; I have known several pairs of the Common Pochard (*Fuligula ferina*) kept for years in places well-suited for breeding (where many wild species and one of this genus annually breed), yet these birds showed no inclination to breed, although they were perfectly healthy, and assumed the breeding dress at the proper season. As these birds have the power of suppressing and checking their desires when not in a perfect state of nature, I cannot imagine or think it probable that they would associate and breed, in a state of nature, with species distinct from themselves, possessing as they do the power of travelling over the globe if necessary to find a mate of its own species. Again, the fact of three specimens having been obtained at distant periods, agreeing in internal as well as external characters, is I think sufficient to prevent any one entertaining such an opinion.

List of Hybrids.

Common Goose...........	Hooper Swan. Chinese Goose. Canada Goose. Bernacle Goose. White-fronted Goose.
Egyptian Goose............	Chinese Goose. Spur-winged Goose. Common Duck.
Canada Goose	Chinese Goose. Bernacle Goose.
Bean Goose	Pink-footed Goose.
White-fronted Goose	Bernacle Goose.
Common Duck	Muscovy Duck. Shelldrake. Pintail Duck. Wigeon. Egyptian Goose.
Shoveller	Garganey Teal.
Pintail	Wigeon.

BOTANICAL SOCIETY OF EDINBURGH.

April 8, 1847.—Dr. Greville, President, in the Chair.

The following communications were read:—

1. "Description of an East Indian Palm, *Areca triandra* of Roxburgh," by Dr. Balfour. The plant has recently flowered in the Botanic Garden; and cut specimens of the spadix, spatha and leaves, with a drawing and dissections of the flowers, were exhibited.

2. "Notes of a botanical trip to the Isle of Wight, in August and September 1846, with remarks on the geographical distribution of the British Flora," by Dr. Balfour. After giving a general description of the geological features of those parts of the island which he had visited, Dr. Balfour enumerated some of the rarer plants found by him near Yarmouth, the Needles, Ventnor, Ryde, and Newport: among these were some of the rarer species of *Rubi*, *Calamintha sylvatica*, *Cyperus longus*, *Matthiola incana*, *Orobanche barbata*, *Inula Helenium*, *Spartina stricta*, *Dianthus prolifer*, *Melampyrum arvense*; remarkable specimens of *Campanula glomerata*, about an inch high; *Agrostis setacea*, *Calamagrostis lanceolata*, *Tamarix anglica*, *Hieracium inuloides*, &c. &c. Dr. Balfour next alluded to the nature of the plants found in the island in a geographical point of view, as belonging to Professor E. Forbes's Devon Flora and Norman Type; and illustrated his remarks by a set of specimens, so arranged as to show at one view the various Floras of Great Britain and Ireland.

Dr. Balfour afterwards read extracts from a letter from Mr. N. B. Ward of London, giving a short account of the successful mode in which he has been cultivating the rarer ferns, Jungermanniæ, and mosses in his plant-cases.

MISCELLANEOUS.

OCCURRENCE OF SERTULARIA ELONGATA, LAMOUROUX.

To the Editors of the Annals of Natural History.

Exeter.

GENTLEMEN,—I have much pleasure in recording the occurrence on the British coast of the beautiful *Sertularia elongata* of Lamouroux, the *S. lycopodium* of Lamarck. A fine specimen of it has come into my hands, which was obtained by a lady, along with a number of sea-weeds, on the south-east or south coast of England.

Dr. Johnston informs me that the *Sertularia elongata* is mentioned by Lamouroux as an English species, but as he does not state on what authority, the author of the 'History of British Zoophytes' has not included it in his admirable work.

This zoophyte, which is an exceedingly pretty one, may be at once distinguished from all our native species of *Sertularia* by the six long spines which arm the wide aperture of each cell. It is an interesting addition to our fauna.

I remain, Gentlemen, yours, &c.,

THOS. HINCKS.

Description of two new genera of Shells. By Dr. PHILIPPI.

In Reeve's 'Conchologia Iconica' we find under *Mitra*, No. 80, a dorsal view of a shell which Reeve states he found in Swainson's collection of species of *Mitra* with the name *Conohelix edentula* attached to it, but that it is decidedly a *Conus*. No description of this species however is given in Reeve's monograph of *Conus*. I had the good fortune to obtain this specimen last autumn by purchase, and am fully convinced that it belongs neither to *Mitra* nor to *Conus*, but must form a distinct genus which I have called *Dibaphus*, which will indicate its two colours, and at the same time call to mind its having been named twice. It may be briefly characterized as follows :—

Dibaphus, Ph., n. gen. Ctenobranchiorum.

Testa spiralis, subcylindrica, in spiram acutam terminata; apertura angusta, linearis, edentula, basi excisa; columella basi recurva; labrum incrassatum, rectilineum, basi rotundatum et abbreviatum; labium nullum; superficies epidermide (tenui ?) vestita. Animal . . .

The second new genus, which I propose to call *Amphichæna*, may be characterized as follows :—

Amphichæna, Ph., n. gen.

Testa bivalvis, æquivalvis, subæquilateralis, utrinque hians, oblongo-linearis; apices parvi, parum prominuli; cardo in valva sinistra dentibus duobus, in valva dextra dentibus tribus constans; ligamentum externum, nymphæ parum conspicuæ; impressiones musculares duæ; sinus palliaris profundus; margo internus antice crenatus, crassior. Animal . . . .

Species unica :

Amphichæna Kindermanni, Ph.

Hab. litus Oceani Pacifici ad oppidum Mexicanum Mazatlan.

I obtained this remarkable shell from M. Kindermann in Valparaiso.—*Wiegmann's Archiv*, Part I. 1847.

INFUSORIAL DEPOSIT AT DOLGELLY, NORTH WALES.

To the Editors of the Annals of Natural History.

Lancaster, May 12, 1847.

GENTLEMEN,—It may interest some of your readers to learn that an infusorial earth has been found near Dolgelly in North Wales.

This substance appears to have attracted the notice of some gentlemen engaged in the Geological Survey, who transmitted it to London for chemical analysis. A small portion came into my hands, and the microscope showed that it consisted almost exclusively of siliceous infusoria more or less perfect*. I am informed that this earth can be procured, in considerable quantity if desirable, on application either to Mr. James Price, Goat, or to Mr. James Jones, Saddler, Dolgelly. I am, Gentlemen, yours very truly,

CHRISTOPHER JOHNSON.

A Sketch of the Geology of Texas. By Dr. FERDINAND RŒMER.

During the four months which I have already passed in Texas, my time has been employed in the study of its geological relations : and although my knowledge of the country is yet incomplete and mostly confined to the western section of the territory, I may hope that the following sketch of what I have seen, considering the little that is known, will prove of interest to your readers, and afford a basis for further investigations.

It is not a very encouraging fact to the geologist in Texas, that only there, where civilization ceases and the wilderness commences, the geological relations of the country begin to be interesting. The line which separates the settled part of the country from the hunting grounds of the Indians, is almost exactly identical with that which divides the more modern diluvial and alluvial deposits from the secondary formations. The three points, lying in the same straight line, San Antonio di Bexar, New Braunfels, (the German settlement on the Guadaloupe,) and Austin, are alike the extreme frontier parts of Western Texas, and the limit of the cretaceous deposits of the upper country towards the south-east. In the few observations which I have to make, I shall therefore separate the particulars relating to the lower country from those bearing upon the secondary formations in the section of country lying beyond the just-mentioned line.

The route by which I reached the north-western section of the country, leading through Houston, San Felipe, Austin, Columbus

* From an examination of a sample kindly forwarded by our correspondent, we can most fully confirm his statement. It abounds in forms of *Bacillaria, Navicula, Gaillonella*, &c.; and contains some remarkably beautiful and peculiar annular forms.—W. F.

on the Colorado, Gonzales and Seguin, is nearly devoid of any geological interest; you see no solid rock in place through the whole distance, excepting irregular layers of a coarse calcareous sandstone of very modern origin, exposed on the steep banks of some of the rivers. The surface is elsewhere a thick diluvium of loose materials consisting either of a fertile vegetable mould, or of rounded pieces of hydrate of iron, as over the barren section between San Felipe and Columbus, or of sand and gravel, as near Gonzales and elsewhere.

The gravel and sand are of some interest on account of the abundance of fossil wood which they contain at many different places. I saw numerous localities of it between San Felipe on the Brazos and Gonzales, and in the valley of the Colorado between La Grange and Austin. This petrified wood is often found in large pieces, and it is said that occasionally whole trunks of trees are met with, which however I have not myself seen. The fossilization of the wood is generally imperfect, the silex into which it has been turned showing most minutely the original structure. Most of the wood is dicotyledonous; but not having the leisure or the necessary books of reference, I have not made out the species. I have only observed that in some of the wood the fibres are extremely close, and the whole structure very compact, exceeding any tree in the existing flora of Texas.

As the gravel and sand in which most of this fossil wood occurs is generally covered by post oak timber, which alone grows on a soil of such sterility, it is a common belief among the farmers of the country that the fossil wood was derived from similar oak-trees of earlier growth in the same region. But this is evidently a mistake, as the fragments bear distinct marks of having been rolled and transported by water; and the question arises as to the geological formation in which this wood was originally deposited and petrified. The gravel where it occurs consists chiefly of rounded pebbles of silex, mostly of a reddish colour, and of a similar appearance to the silex of the cretaceous formation in the upper country. This might lead to the supposition, that the wood as well as the pebbles derive their origin from cretaceous strata. But it is an objection to this view, that no remains of dicotyledonous plants (the Coniferæ and Cycadeæ excluded) have hitherto been found in strata older than the tertiary deposits, excepting the leaves of *Credneria* in the greensand of Germany; and moreover, the fossil wood becomes scarce as you approach the hilly country where the cretaceous strata are in place. We may hope that the doubt will be removed by an examination of the eastern section of the country, where the fossil wood is said to be still more abundant, and where according to Kennedy*, between the Trinity and Nueces rivers, great numbers of petrified trees lie imbedded in the soil.

The thickness of the diluvial beds diminishes when you approach the cretaceous deposits, and when you are near the above-mentioned line the cretaceous strata begin to show themselves in the deep ravines and gullies; but they do not appear at the surface until you pass that line.

* Texas, vol. i. p. 119.

At the same time the topographical character of the country entirely changes. Instead of the low undulations of the prairies, hills of considerable height with sharply defined outline, and but a short distance beyond, real mountain ranges show themselves to the north, marking the limit between the rolling and mountainous region of Texas.

The place where I first met with a cretaceous deposit was at New Braunfels, exactly where the old Precidio road from San Antonio to Nacogdoches crosses the Guadaloupe. Here in the bed of the river a white limestone is exposed which looks very similar to the "chalk marl" of England, and to the "plänerkalk" of Saxony. It is white, rather compact, in some beds more marly, and occasionally it contains green particles of silicate of iron. The stratification is perfectly horizontal. Some of the strata abound in fossils. The most common species is a small Ostrea, similar to *Ostrea vesicularis*, Lamk., but never growing as large, and generally not being more than one inch in diameter. Next to it comes a large species of Exogyra, analogous in form to *Exogyra costata*, Say, but having concentric laminæ instead of the oblique folds of that species. It certainly is the largest species of the genus, as some specimens of it are more than nine inches in length. Equally common with this Exogyra, there are two species of Inoceramus, one of them being similar to the *Inoceramus Cuvieri*, Sowerby, and the other to the *Inoceramus Cripsii*, Mantell. The *Pecten quadricostatus* is also abundant in some beds, a characteristic fossil, widely spread in cretaceous deposits. Of the large family of the Brachiopoda, I saw but a few specimens of *Terebratula gracilis*. The family of the Cephalopoda is not better represented. I saw two species of Ammonite, one of them of the section which the *Ammonites varians* belongs to, and a Nautilus, which certainly is nearly allied to the common *Nautilus simplex*, if not identical with it. In one stratum which is only about five inches thick, sharks' teeth of the genus *Lamna* and other genera abound.

The same limestone ranges very far on both sides of the Guadaloupe, and everywhere parallel to the chain of high hills or mountains which separate the Indian country from the settled part of Texas. On one side I have followed it as far as Austin on the Colorado. The hills, on the slopes of which this city is so handsomely situated, consist of limestone with the same mineralogical and organic characters as that on the Guadaloupe. Among the fossils I found here a large Ammonite similar to the *Ammonites Rhotomagensis*, Sowerby. Near Austin also a single specimen of the *Exogyra costata*, Say, was met with. It seems that this species among the fossils of the North American cretaceous formation has the widest range. Besides its most abundant occurrence in the cretaceous marl of New Jersey and at some places in the Southern States, it is mentioned by Featherstonhaugh * to be frequent at different localities in the State of Arkansas.

From several facts I have obtained, it is certain that the same limestone extends beyond Austin much farther to the north-east. On the other side of the Guadaloupe, the limestone is exposed in many

* Excursion into the Slave States, p. 119.

places on the road from New Braunfels to San Antonio, which leads in a south-western direction. Where the road crosses the Cibolo, the limestone forms in the bed of the river singularly shaped rocks, through which the water has eaten its channel, and which are teeming with fossils. At San Antonio the limestone is opened by several stone quarries, and the far-famed Alamo mission has been built of it. West and south of San Antonio, I have not yet seen the limestone myself, but I have reason to believe that it extends much farther in both directions. A specimen of the same Exogyra which abounds on the Guadaloupe was brought to me, and said to have been found among the pebbles in the bed of the Rio Grande.

Besides this white marly limestone, there is another series of strata to be described. Ascending, from New Braunfels, the range of steep hills which stretches to the north-west of this place, as soon as you leave the level of the valley, horizontal strata of a compact yellowish limestone are seen, resembling very much the compact limestone of Italy, and of Southern Europe in general. Some of the strata are very siliceous, containing large compressed nodules of pure dark-coloured silica. Other beds are so soft that they easily decompose through the action of air. Where limestone is very compact, hardly any trace of fossils is seen in it, but some of the looser strata abound with shells. Among them there is a small species of Exogyra, which from its prominent, spiral beaks and general shape might easily be mistaken for a species of Chama or Diceras; it is very common, and in some localities occurs in great abundance. Together with this Exogyra, there is in most places a new species of Gryphæa; also a smooth and globose Terebratula, and occasionally a specimen of *Pecten quadricostatus*. These beds of soft marly limestone are not only seen everywhere on the mountains in the neighbourhood of New Braunfels, but they extend north of this place about seventy miles as far as to the Piedernales river, everywhere containing the same fossils. Over the same wide range, there are other fossiliferous strata of an entirely different character. I saw them first in a deep ravine near the narrow rock-bound channel of the Guadaloupe, eight miles north of New Braunfels. One thick bed of compact limestone contains in immense numbers certain organic bodies of cylindrical shape. These fossils are generally an inch or two in diameter, twisted both ways, and mostly furrowed longitudinally on the surface. At first view I was rather puzzled as to their relations, but on closer inspection of their internal structure, it became evident that they must belong to the order of the Hippurites, that singular division of shells which gives the peculiar fossil character to the cretaceous formation of Southern Europe, from Lisbon in Portugal as far as Asia Minor along the Mediterranean. Some beautiful specimens of a real Hippurites resembling very much a species of Southern France were afterwards met with. In the same beds of limestone with these Hippurites, several species of bivalve shells are found which belong to genera equally characteristic of the Mediterranean cretaceous formations, viz. Diceras and some analogous genera. At last in the same beds also occur a large Pecten of the same section as the *Pecten quadricostatus*, besides several univalves.

Some Hippurites and several species of the Diceras family were also found on the Piedernales; so that it seems probable that the strata just described have a very extensive range.

Having presented the facts observed, I offer a few general conclusions from them. At first there cannot be the least doubt that all the strata just described are equivalent to the cretaceous formation of Europe. The identity in the general character of the fossils incontestably proves it. It is more doubtful to which division of the cretaceous formation they ought to be referred. So much however is certain *à priori*, that they do not represent the lowest divisions of the cretaceous system; since among the organic remains there are no characteristic fossils of the lower greensand or of the gault. The fossils of the white marly limestone first mentioned indicate an age not older than that of the "chalk marl" of England in the series of the cretaceous deposits of Europe. We might even be inclined to believe those strata equivalent to the white chalk of Europe, if some of the most characteristic fossils of the chalk among them, especially the *Belemnites mucronatus*, were not wanting altogether. The system of strata partly consisting of compact siliceous limestone, and containing fossils of the Hippurite order, next described, belong still higher in the European series; for near New Braunfels they certainly lie above the marly limestone. From some observations however made at other localities, I have reason to believe that the two systems of strata are not everywhere so distinctly separated, and form together a single continuous succession of strata of nearly the same age; and with regard to the age we can at present only say, that the beds belong to the upper division of the cretaceous formation. It is interesting to compare these cretaceous deposits with the cretaceous strata of New Jersey, Virginia, &c. In the latter regions we find beds of a loose calcareous marl and of ferruginous sand, representing the upper division of the cretaceous formation. In their fossils and also their mineralogical constitution they bear a striking analogy to some deposits of England and Germany. In Texas we have a system of rocks which equally correspond to the upper division of the cretaceous formation, but of a very different character, and not consisting like those just mentioned of loose unconnected materials, but partly at least a very compact siliceous limestone. By their fossils as well as the composition of the rocks, they are closely allied to the cretaceous formation as it is developed in the south of Europe along the Mediterranean.

A new and interesting analogy in the geological constitution of the two continents has thus been ascertained, proving the general similarity of physical condition and of the laws of organic life in both hemispheres during the period when the cretaceous strata were originally deposited.

Still another observation of a general character remains to be stated respecting these cretaceous deposits. About twenty miles north of Fredericksburg, the new German settlement on the Piedernales river, a rock more than one hundred feet high with nearly perpendicular sides stands out from the ground. This rock, which very probably is identical with that which has been laid down on the maps of

Wilson and others as "the enchanted rock," consists of a rather coarse-grained granite. I obtained specimens of the granite from some friends of mine who were on the spot, and ascertained also that beds of limestone extended to the very base of the rock. This fact, in connexion with the other one, that on the San Saba river, silver-mines have been worked formerly by the Spaniards in a plutonic rock, seem to lead to the supposition that here, on the tributaries of the Colorado, we arrive at the boundary where the stratified rocks of the east side of the continent come in contact with the crystalline masses of the Rocky Mountains. If this supposition is correct, it follows that the cretaceous formation is the only one of the whole series of stratified rocks which exists in this part of Texas. From the facts observed in Texas, we derive additional confirmation of the hypothesis long since made with great sagacity by M. Leopold von Buch and never refuted, that the oolite series of Europe have no equivalent on the American continent.

In the course of this summer I hope to extend my investigations to other parts of the country, and may be able then to give your readers some more satisfactory information about its geological relations.—*Silliman's American Journal,* Nov. 1846.

METEOROLOGICAL OBSERVATIONS FOR APRIL 1847.

Chiswick.—April 1. Slight haze: sleet and hail-showers: frosty. 2. Overcast. 3. Cloudy and cold: rain. 4. Overcast. 5. Cloudy: fine. 6. Cloudy: rain at night. 7. Cloudy: rain. 8. Rain: cloudy: clear. 9. Clear and cold. 10. Cloudy: fine. 11. Uniformly overcast: rain. 12. Rain: cloudy. 13. Densely clouded. 14. Bleak and cold: slight hail-showers. 15. Snow and hail: clear, cold and dry: sharp frost at night. 16. Sharp frost: clear and cold. 17. Frosty and foggy: cold and dry. 18. Clear. 19. Clear: cloudy: slight frost. 20. Foggy: fine, with sun: cloudy. 21. Clear: overcast. 22. Cold haze: frosty. 23. Fine: clear at night. 24. Slight haze: fine, with sun: frosty. 25. Foggy: fine. 26. Rain: overcast. 27. Boisterous, with showers. 28. Fine: showery. 29. Heavy showers, partly hail: thunder. 30. Clear: heavy clouds and showers.

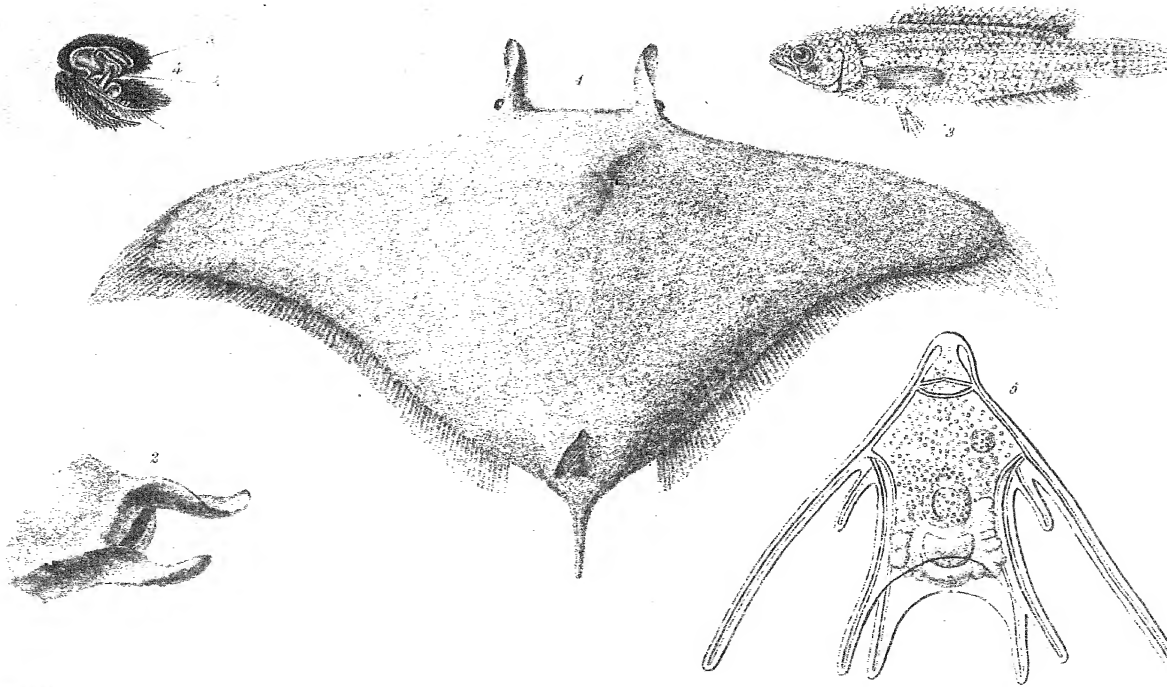
Mean temperature of the month	44°·28
Mean temperature of April 1846	47 ·36
Mean temperature of April for the last twenty years ...	47 ·20
Average amount of rain in April	1·47 inch.

Boston.—April 1. Cloudy: snow A.M. and P.M.: rain yesterday. 2. Cloudy: large fall of snow A.M.: rain P.M. 3. Cloudy: snow A.M.: rain P.M. 4—6. Fine. 7. Cloudy. 8. Rain: rain early A.M.: stormy, with rain P.M. 9. Stormy. 10. Fine. 11. Fine: rain A.M. and P.M. 12, 13. Cloudy. 14. Fine. 15. Cloudy: snow-showers. 16. Fine. 17, 18. Fine: ice this morning. 19. Cloudy. 20—23. Fine. 24. Fine: rain P.M. 25. Cloudy: rain and hail P.M. 26. Rain: rain A.M. 27. Windy: rain P.M. 28. Windy. 29. Fine. 30. Cloudy: thunder and rain P.M.

Sandwick Manse, Orkney.—April 1. Snowing: snow. 2. Snowing: showers: snow-showers. 3. Cloudy. 4. Bright: damp. 5. Sleet-showers: showers. 6. Bright: showers. 7. Bright: hail-showers: aurora. 8. Rain: showers. 9. Showers: clear: aurora. 10. Clear. 11. Clear: rain. 12. Bright: cloudy. 13. Snow-showers: cloudy. 14, 15. Cloudy. 16. Clear: cloudy. 17. Showers: clear. 18. Showers: cloudy. 19. Fine: clear. 20. Showers: clear. 21. Cloudy: clear: frost. 22. Bright: cloudy. 23. Bright: showers. 24. Showers: drops. 25. Bright: cloudy. 26. Bright: clear. 27. Bright: rain. 28 Showers: drizzle. 29, 30. Bright: clear.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *by the* Rev. W. Dunbar, *at Applegarth Manse,* Dumfries-shire; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. April.	Max.	Min.		9 a.m.	9 p.m.	9¾ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9¾ a.m.	8½ p.m.								
1.	29·404	29·300	29·08			29·37	29·42	46	23	38			36	34	s.	nw.		nne.	·05	·08		·28
2.	29·333	29·247	28·95			29·54	29·60	44	28	36·5			37	37	n.	calm		ne.	......	......		·07
3.	29·452	29·340	29·04			29·60	29·58	44	32	35			39	38	nw.	nw.		w.	·04	·18		·05
4.	29·702	29·693	29·39			29·46	29·33	50	37	42			43½	43	nw.	ne.		sw.	·02	·22		......
5.	29·745	29·629	29·33			29·35	29·45	56	39	42			43½	41	w.	n.		nw.	......	......		·21
6.	29·853	29·745	29·36			29·65	29·45	55	44	46			43	43	n.	n.		se.	·04	......		·08
7.	29·837	29·813	29·36			29·43	29·48	56	42	49			44	42½	w.	calm		w.	·10	......		·07
☾ 8.	29·625	29·549	29·08			28·61	28·54	58	38	51			41½	40	w.	calm		nw.	·02	·36		·41
9.	29·775	29·689	29·16			29·18	29·48	55	34	47·5			40	39	w.	w.		nw.	......	·09		·62
10.	29·900	29·695	29·49			29·70	29·82	58	30	46			44	39	w.	w.		calm	......	......		·43
11.	29·945	29·784	29·69			29·78	29·54	50	47	43			44	44	s.	calm		se.	·10	......		·02
12.	29·706	29·677	29·30			29·68	29·86	64	42	53			44	38	sw.	calm		nnw.	·28	·07		·11
13.	29·922	29·841	29·50			30·01	30·18	51	33	47			41	38	ne.	e.		n.	·01	......		·03
14.	29·947	29·912	29·64			30·17	30·08	48	34	47			39½	42	ne.	ne.		w.	......	......		......
● 15.	30·025	29·906	29·61			30·05	30·02	48	23	41·5			46	43	ne.	e.		s.	·01	......		·05
16.	30·026	29·926	29·69			29·85	29·72	49	20	41			45½	45½	n.	n.		sse.	......	......		......
17.	29·824	29·757	29·52			29·69	29·84	54	22	43			44	43	se.	se.		nw.	......	......		·15
18.	29·876	29·790	29·54			29·95	29·90	52	34	45			44	40½	ne.	n.		e.	......	......		·03
19.	29·813	29·712	29·39			29·76	29·76	57	27	41			43½	40	sw.	n.		calm	......	......		......
20.	29·884	29·742	29·50			29·84	29·95	60	30	46			43	42	sw.	calm		ne.	......	......		·06
21.	30·027	29·962	29·57			30·02	30·06	61	36	51·5			45½	38½	w.	n.		ne.	......	......		......
☽ 22.	30·064	29·950	29·71			30·06	30·05	60	26	50			47	41	ne.	calm		calm	......	......		......
23.	30·024	29·974	29·67			29·93	29·93	59	30	49			45	42	e.	calm		e.	......	......		·04
24.	29·987	29·962	29·60			29·92	29·92	58	28	48·5			43	41	e.	s.		se.	......	......		·12
25.	29·997	29·951	29·57			29·89	29·66	62	36	51			45½	44	sw.	sw.		se.	......	·11		......
26.	29·788	29·781	29·30			29·25	29·30	57	43	43			41½	43½	sw.	w.		w.	·11	·21		·01
27.	29·728	29·615	29·11			28·90	28·48	61	43	56			49	45½	w.	w.		s.	·01	·05		......
28.	29·696	29·579	29·18			28·80	29·00	60	40	53			47	45	sw.	w.		nw.	·07	·12		·35
29.	29·571	29·528	29·10			29·31	29·50	57	35	51			45	41½	sw.	calm		wnw.	·20	......		·13
○ 30.	29·794	29·667	29·24			29·59	29·68	61	30	46			47½	41	nw.	w.		se.	·02	·28		......
Mean.	29·809	29·726	29·38			29·611	29·619	55·03	33·53	45·9			43·40	41·11					1·08	1·77		3·32



J. De C. Sowerby lith.

Hullmandel & Walton Lithographers

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XLV.—*On the Larval State and Metamorphosis of the* Ophiuridæ *and* Echinidæ. By Prof. J. Müller*.

[With a Plate.]

I had occasion last year to describe some animal forms observed near Heligoland, among which was one peculiarly remarkable from its form and skeleton, to which I gave the name of *Pluteus paradoxus*. During the present year I have been able to extend my observations and to study the further development and metamorphosis of this remarkable animal, which have proved highly interesting. In fact, an *Ophiura* is developed from it; *Pluteus paradoxus* is consequently the larva of an *Ophiura*.

The first observations instituted on the development of an Echinoderm were those of M. Sars on *Echinaster sanguinolentus* (*Echinaster Sarsii*, Müll., Trosch.) and *Asteracanthion Mülleri*, Sars. This naturalist, to whom we are already indebted for the discovery of many important facts on the changes in form of the lower animals during their development, has also observed, that the young *Asteriæ* have no similarity to their later forms. The larva of *Echinaster*, when it escapes from the ovum, is of an oval form, without any external organs, and by means of innumerable cilia which cover the body swims about free in the water just as the Infusoria, or the *Medusæ*, *Coryne* and *Alcyone* in their young state do. In a few days organs grow out at that extremity of the body which, when they swim, is seen to be the anterior; these serve for attachment. They consist of four bulbous tubercles with a smaller one in the centre. By the aid of these organs the young one fixes itself firmly to the marsupial cavity of the mother. These tubercles disappear when the body of the animal is developed into the radiate form. M. Sars has not given any illustration of the internal structure of these young Echinodermata or larvæ, which is sufficiently explained by their being perfectly opake.

The larvæ of the Echinodermata, which form the subject of the present notice, are so transparent, that they admitted of a microscopic analysis with a magnifying power of 250 diameters.

* Translated by Dr. Griffith from the Berichte der Berliner Akademie for Oct. 29, 1846.

Before *Pluteus paradoxus* exhibits any trace of a star-fish, it has the form figured in Pl. XI. fig. 5. It has no further resemblance to the larvæ described by M. Sars than in the appendages being developed in one direction and the animal being bilateral. In other respects the form is so peculiar and so very dissimilar, that it would never be suspected to be the larva of an Echinoderm, notwithstanding the previous observations of M. Sars. The appendages are numerous, viz. eight, and very long; they have no relation to tubercles and organs for attachment. The elegant skeleton of *Pluteus* has been already described. We must now add, that it is calcareous and dissolves in acids. The observations made during the present year, for the first time afford an explanation of its further internal structure and vital phænomena. The membrane which covers the columns of *Pluteus* extends over the body of the animal in arches from one column to the other. The intermediate substance descends deeper between two only of the columns which we shall call the posterior. The mouth is situated at the part at which, in my previous treatise, I noticed the occurrence of motion. Opposite the mouth at the anterior side, the skin of the body is extended between two of the columns like a marquise over a door. The oblique lower lip projects considerably forward at the mouth. The oral cavity leads upwards into an œsophagus, and this is connected by a contraction with the cæcal stomach, which fills the cavity of the body between those columns which are inclined towards each other. The stomach is often divided by a constriction into an ascending portion and a blind pouch recurved anteriorly. Two granular, glandular bodies, of the use of which I am ignorant, are situated on each side of the œsophagus and stomach. Before the metamorphosis commences, *Pluteus paradoxus* is rather less than half a line ($\frac{2}{5}$) in size. It occurs in great numbers during the months of August and September in the open sea near the surface, and swims by ciliary motion, usually with the appendages forwards; but sometimes it continues to revolve horizontally, whilst the azygous extremity and the long appendages retain an opposite and horizontal direction. Ciliary motion exists throughout the stomach, in the œsophagus and the cavity of the mouth; as also definitely distributed on the outside of the body. The mouth is surrounded by a tuft of cilia. The acute, azygous extremity of the animal is also surrounded by a circular tuft of cilia; the cilia then expand into the eight long appendages, so that in each there are two rows or tufted lines, upon which they are situated. Both rows or lines at the extremity of the appendage curve into one another; between two of the appendages or arms the line of cilia runs from one arm to the other on the arches we have mentioned; thus the entire animal is surrounded by a ciliated organ of

a linear form, which returns into itself, ascends and descends upon the arms in loops and passes from one arm to the other. In the situation of the mouth it passes beneath it. Ciliary motion alone effects the entire locomotion of the animal; all other spontaneous motion is confined to the closure of the mouth and œsophagus which takes place from time to time. The walls of the stomach are of a granular or cellular structure and appear green, the larva is otherwise perfectly transparent; its azygous apex and the extremities of all the arms are of an orange colour.

Distinct indications of the nervous system were also perceived. They consist of two small knots below the mouth, a right and left, which are connected by a filament, and send several filaments upwards towards the mouth and one downwards.

These *Ophiura* larvæ are not luminous.

The first indication, both internally and externally, of the transformation of the *Pluteus* into an Echinoderm, consists in the appearance of certain cæcal figures with double contours at the sides of the stomach and œsophagus. They are seen to form a row, first upon one and soon afterwards upon the other side of the stomach and œsophagus. The minute cæca are situated towards the exterior; their bases, which are connected together, are turned towards the stomach; each row appears like a thick membrane which has been thrown into cæcal folds. They soon completely surround the stomach like a wreath. At first they do not project beyond the surface of the *Pluteus*, but lie within its substance, their contours being lost in it, but by their growth they soon project beyond the surface of the *Pluteus*; subsequently others are developed which project beyond the crown formed by the former; these are neither more nor less than ten, each pair being situated near each other: this is the first appearance of the arms. The two belonging to each arm then fuse together, and the whole assumes the form of a disc, which is grown over by five short appendages. The former arms or columns of the *Pluteus* take no part in this formation. The *Pluteus* holds the same relations to the star-fish which is forming within it, as the embroidery frame does to the embroidery which is worked within it. Moreover the arms of the *Pluteus* have no relation to the arms of the Echinoderm. The latter is situated obliquely within the body of the *Pluteus*, so that one of the arms of the star-fish crosses the great axis of the *Pluteus*, and comes into view on the side of the azygous apex of the *Pluteus*. As soon as the cæca become arranged in the form of a crown or star, the deposition of lime occurs in the form of ramified figures in the new formation; during their further development these assume the form of a lattice-work, as is peculiar to the skeleton of Echinodermata. With the development of the minute cæca into a crown, distortion occurs at

that part of the *Pluteus* where the mouth was situated. This region now appears as if forcibly drawn obliquely upwards, and no further trace of the mouth of the larva is seen. But instead of the former lateral mouth of the *Pluteus*, there now appears a central mouth for the Echinoderm.

I have not been able to decide whether the mouth of the larva is transformed into the mouth of the *Ophiura*, or whether the latter is of perfectly independent origin and the former disappears. In the true *Echinidæ*, as in *Echinaster*, that spot in the newly-formed Echinoderm, at which the mouth is subsequently situated, is still perfectly closed, even when the first tentacles are formed. The mouth of the young *Ophiura* is at first round and totally dissimilar to the mouth of the larva; it gradually assumes a stellate form.

In the *Echinidæ*, where, as we shall hereafter see, four sides can be distinguished in the larva, the formation of the mouth of the *Echinus* is always independent of the mouth of the larva; for none of the poles of the young *Echinus* formed in the larva correspond to that side of the larva in which the mouth of the larva occurs.

In its present condition the newly-formed star-fish is always smaller than the remains of the *Pluteus*, but the more the star-fish grows, the more do the appendages and the azygous apex of the *Pluteus* appear as mere appendages of the star-fish. The azygous summit of the *Pluteus*, its two long lateral arms, and one of the two lower arms remain longest, but on the growth of the star-fish these at last also disappear. The stomach is the only structure in the new being which is completely received from the *Pluteus*.

The tentacles or feet of the young star-fish are also formed before the arms of the *Pluteus* disappear. At first there are only ten of them, which inclose the disc itself in a crown. Before the loss of any of the arms, two foramina are formed in the disc, from which the animal exserts the tentacles. At this period it still lives in the sea as before, but when it lies on the bottom of a vessel, it gropes about with the tentacles. The tentacles or little feet are covered with small knots, as in the *Ophiuræ*. In this state the animals move exactly as formerly by ciliary action, and we very frequently see the circular rotation in the plane of the longest or lateral arm of the *Pluteus*. So far we are unable to guess from the form of the animal, whether an *Asterias* or an *Ophiura* will form from the *Pluteus*; its remarkable difference from the larva of the *Asterias* of Sars indicates something distinct, and in fact the characters of the *Ophiura* soon show themselves. Shortly before the time when the last traces of the *Pluteus* disappear, we see that the arms of the star-fish are deposited by the disc and as it were articulated. But this

arm is now nothing more than the most external or terminal member of the future *Ophiura*. Just as the first tentacles are formed upon the disc itself, so is it with the first spines, ten of which are seen, each being traversed by a calcareous network, and situated near its tentacle. The animal has the power of spontaneously moving these spines, which also indicates the *Ophiura*. As soon as the young *Ophiura* has become developed, it is furnished with a disc which is traversed by lattice-work and incloses the stomach, and a mouth which is encircled by five triangular interradial plates; outside these plates, on the abdominal side of the disc, there are two spines placed near each other, and sufficiently large to project beyond the margin of the disc. The two tentacles appear before the loss of the articulated arms. The arm-segment itself is narrow at the root, altogether it is longish and inflated. We meet with these young *Ophiuræ* in the upper parts of the open sea, although all traces of the organization of the *Pluteus* have disappeared. In size they are about equal to the breadth of the original *Pluteus*, and are about two-thirds of its length. The new segment of the arm is formed between the disc and the primitive segment, and is furnished with two spines articulated anteriorly to the sides, and two tentacles, one on each side. The young *Ophiura* with the two arm-segments is half a line in length. Subsequently a new segment is again formed between the disc and the arm and furnished with spines and tentacles. I have found these young *Ophiuræ* free in the sea up to that period at which their arms had four segments, and the number of spines on the segments had increased to two on each side of every segment. The entire animal has at this period a diameter of $\frac{3}{4}$—1 line. The terminal segments of the arms or the primitive segments have not become altered either in form or size. The subsequent segments differ in form, being of a polygonal shape, as is peculiar to the segments of the arms of the *Ophiuræ*. The origin of all the new segments is from the ventral surface of the disc itself, between the interradial plates of the disc, where the segments of the arms run towards the angle of the mouth. As soon as the new segment has grown beyond the disc, it forms the largest of the arm-segments. Thus far the genus of *Ophiuridæ* to which it belongs cannot be determined with certainty; probably it is an *Ophiolepis*, several species of which occur in the German Ocean.

Besides the above-described *Ophiura*, which in a very large number of specimens may be observed in all the transition stages, I found another *Pluteus*, *i. e.* the larva of another species of *Ophiura*; this however was only seen once. In form and in the skeleton it exactly resembled *Pluteus paradoxus*, but the arms of the larva diverged considerably more, and were much longer and

thinner. The uniform colour of the transparent animalcule was a very pale violet. Its size was double that of *Pluteus paradoxus*. There were no indications of its development into the star-fish.

I now come to another class of Echinodermatous larvæ, which I have traced as far as the period of their metamorphosis, so that there is no doubt in my mind regarding their Echinoid nature. I had no opportunity of observing the earliest development of the *Echinus* from the ovum, upon which point H. von Baer has instituted investigations by the artificial impregnation of the ova*. Von Baer compares the embryos of the *Echinus* to the earliest forms of the larvæ of the *Medusæ*, such as *Aurelia aurita*, as they occur in the sacs on the margins of the arms, except that they are much broader. During their further change, they appeared as if about to approach the *Beroë* in structure; on the fourth day they assumed very irregular forms which differed from each other; on the fifth day they were all dead. The motion of the larva when it has quitted the ovum is effected by cilia. Von Baer estimates the diameter of the young *Echinus* which he observed at $\frac{1}{50}$th of a line.

The animals which formed the subject of my investigations, and which I consider as the larvæ of *Echini*, are much older, about half a line in diameter; in this condition they have no resemblance to the larvæ of the *Medusæ* and *Beroë*. I have observed three kinds of the Echinoid larvæ, two of which appear to belong to one and the same genus, the third to another genus of *Echini*.

One form, which I shall describe first, has an arched body, and may be compared to a spheroid or dome with four columnar, somewhat divergent, elongated supports or feet. These calcareous columns are continued into the spheroid, where they are further distributed in a peculiar manner, and which can only be rendered intelligible by figures. The columns are covered by the skin of the larva which forms the spheroid, and which forms arches at the margin of the arch between the columns. The spheroid has two broad and two narrow sides. The broad may be distinguished as the anterior and the posterior sides. Between the two anterior columns the skin of the larva forms a tent-like expansion at the margin of the spheroid; on the opposite posterior side the animal substance is continued from the dome into a long appendage, which is fixed by four separate columns, so that there are two on each side. This elongation contains the mouth and the œsophagus, the stomach is situated beneath the dome.

To assist comprehension by a comparison, the larva resembles a clock-case resting upon four long feet, from the back of which

* Bull. de l'Acad. Imp. de St. Pétersb. t. v. n. 15. p. 231.

the pendulum descends, which may be compared in our larvæ to the framework of the mouth. The columns of the oral framework also contain internally a calcareous column; two of these calcareous columns are branches of the two belonging to the four main columns, and pass off within the arched central body from those of the former which support the tent. The other two calcareous columns unite together at the back part of the dome at an angle, from which a single branch ramifies in the dome. The skin, which covers all the columns, the central body, and the expansion at the mouth, is spotted with sulphur-yellow and brown spots. The distribution of the ciliated organs is very peculiar. These larvæ are furnished with oblique tufts resembling epaulettes which are situated upon those spots where the four supports of the dome pass into it; the tufts are also covered with very long moving cilia; a thick mass of sulphur-yellow pigment lies beneath the tufts. Moreover these larvæ are furnished with a row of cilia upon all the columns and on the dome itself, as is the case with the *Pluteus*. Two rows run upon each column; these run into one another at the extremity and superiorly at the dome from one ray to the others. At the anterior margin of the dome, where the latter is expanded like a tent, the row of cilia follows the margin of this protection: not so at the sides; the arch of the row of cilia here lies much higher than the margin of the dome, and ascends almost as far as its summit. The columns also between which the mouth and œsophagus are situated are covered by a row of cilia, which passes from one ray to the other on the same side, and in the centre runs beneath the mouth from one side to the other. The mouth is surrounded by a distinct tuft of cilia. It is triangular, and bounded inferiorly by an oblique, basin-like projecting lip; the two other or upper sides are inclined to each other at an angle. In this direction the cavity of the mouth is continued into the œsophagus, which leads to the blind sac of the stomach. The latter receives the internal portion of the arched central body, and is frequently bent in several places, so that one portion of the blind sac is curved forwards. Both the mouth and the œsophagus contract powerfully from time to time. The interior of the cavity of the mouth, the œsophagus and the stomach is ciliated. These larvæ are about half a line long, and live unattached in the water, their motions being entirely effected by cilia. All the arms are immoveable; the columns which lie between the mouth and the œsophagus merely undergo a passive motion from the powerful contraction of the mouth and œsophagus.

The first appearance of alteration is recognised in these larvæ by a discoid plate, which is produced in the months of August and September on one of the narrow sides of the dome beneath

the spotted skin of the latter, and which is inclined at an acute angle towards the summit of the dome. In our comparison of the framework with a pendulum it forms as it were the dial-plate, but the position of the dial-plate would be heterologous to that of the pendulum; and it would be situated at the side of the clock-case. This disc is thus heterologous in position with the mouth of the larva. The round disc, which is now but slightly convex, becomes itself again spotted with yellowish spots. It is divided by a five-leaved figure into five valve-like divisions, which are almost in contact in the centre; at the circumference there are intermediate segments between them. Each valvular division has two outlines which are widely separated from each other. Opposite this disc, which forms the earliest appearance of the *Echinus*, there appear upon the dome on each side pedicellariæ, which are furnished with three arms such as are peculiar to the *Echini*; for the pedicellariæ of the *Asteriæ* have two arms. The pedicellariæ lie close to the dome; at this period they also exhibit spontaneous motion, the arms of the pincers opening and shutting. The larva has usually only four pedicellariæ, two on each side, situated near to each other.

During the growth of the disc within the dome, new segments appear at its marginal portions which inclose the five central plates: externally between the five plates there appear five circular figures with double outlines; these are the foundations for the tentacles or feet; for the young Echinoderm which is at this period in the progress of formation possesses the peculiarity, that at first it is furnished with only five regular, symmetrically distributed, large, odd feet, which rise from the apertures of the disc in the form of minute cæca with double outlines. The other peripheral segments, which cannot be confounded with the plates of the shell of the adult *Echinus*, soon shoot up into cylindrical elevations, which are converted into spines. When the young *Echinus* is so far developed as to form a slightly convex disc furnished with spines and five tentacles or soft feet, both the feet and the spines project far beyond the surface of the dome of the larva, the feet move in all directions in a groping manner, and are now in a condition to adhere to objects. The spines are also moveable at the will of the animal. The mouth of the larva still remains in its former position, and like the œsophagus is in full action. The feet are annulated, and like the spines, sparingly spotted with a yellow and brown pigment. Each of the five feet is furnished at its extremity with a disc, in the centre of which there is a tubercle, just as in the feet of the adult *Echinus* in their extended state, and as figured by Monro from life. Within the disc we find a polygonal simple calcareous rim. The minute feet are hollow internally, but at the extremity

the cavity is closed as in all the Echinodermata. At their first appearance the feet are rounded at the extremity; the disc is formed at a somewhat later period. The spines, which soon acquire a considerable length, contain a calcareous framework. When the latter is perfectly developed, it forms an hexagonal prism placed within the cylindrical skin of the spine, which consists of a regular calcareous lattice-work terminating at the extremity in minute teeth. The horizontal arrangement of the axial network of the spine is radiate, so that the extremity of the spine viewed from above exhibits a star with six segments. Before the framework of the spines is thus far developed, when it first appears it has exactly the form of a candelabrum. The basis of the framework of the spine is thus a star with six rays, from the centre of which there arises a simple axis, which immediately subdivides into other branches which subsequently re-unite. In this manner a tubercle is formed which gives off some teeth (*Zacken*) externally. The continued trunk again rises vertically from the tubercle, six long arms proceeding from it; these ascend parallel, and give off teeth externally. The length of the developed spines is so great, that it is about equal to the fourth part of the whole disc of the animal.

It is very enigmatical, that at first the tentacles or feet do not appear in pairs, since these five odd tentacles do not occur in any perfect *Echinus* or Echinoderm. I must leave it undecided, whether the spinous disc under consideration corresponds to the middle ventral portion with the framework of the teeth, as it appears to do, or whether it is the dorsal part of the subsequent *Echinus*. If it were the dorsal portion, the five-cleft figure would exhibit the five genital plates in the centre, and the segments from which the tentacles arose, between the above plates, would correspond to the perforated plates, which M. Agassiz, without sufficient ground, denominates the ocellar plates; the centre between the five original valves would then be considered as the anus. At this period there is no aperture at this point, and the spotted skin of the larva is continued over it. Moreover the shell of the *Echinus* is at this time a delicate structure, the segments of which growing into tentacles and spines cannot be considered as the subsequent plates of the shell, but as the foundations of the tentacles and spines. Moreover the foundations of the subsequent arrangement of the tentacles in pairs may now be recognised, for just anterior to those tentacles which are not in pairs, near the centre, there are two smaller, circular rudiments of the tentacles, lying in pairs; thus a circle of ten tentacles is produced; and more towards the circumference, rudiments of tentacula arranged in pairs are visible. The disc itself, from which the tentacles and spines arise, also contains its peculiar calcareous network, which is not

visible until we examine more minutely. It is first formed from isolated figures with three arms, which are bifurcated and soon form a lattice-work with circular meshes. At this stage of the metamorphosis the larva swims about by its ciliary organs, which remain in full activity, viz. the ciliary lines and the ciliary epaulettes, it creeps with its five feet, moves its pedicellariæ like pincers, and each spine separately. I have not had an opportunity of tracing the metamorphosis of these larvæ: the convex discoid form of the new animal, its total dissimilarity from the *Asteriæ* and *Ophiuræ*, the numerous spontaneously moveable long spines on the disc, and the three-limbed pedicellariæ, leave scarcely any doubt that it represents one of the *Echinidæ*, but it is impossible to say from these data whether it belongs to the genus *Echinus* or *Cidaris*.

To the same genus as that above described, in numerous specimens and in larvæ seen several times almost every day, there belongs also the larva of another species which resembles the former in every respect, and especially in the ciliated epaulettes, but which appeared to differ in the termination of the calcareous axis in the dome; for instead of the round dome, the summit was conical and then truncated at the extremity. The calcareous axes of the two anterior main arms of the larva projected into this extremity and subdivided in the apex into two short oblique branches. The position of the disc in the dome and its structure were the same as in the other species.

My observations on the larvæ of the Echinodermata with ciliated epaulettes have proceeded thus far. To observe the complete development of the *Echinidæ*, it would be necessary to continue the investigations through the first half of the winter. From observations on another species of larva which will be detailed hereafter, it is evident that the young *Echinus* has entirely lost all traces of the larva even when the spinous part of its surface is developed as far as a half of its entire sphere, and that the remaining part of the shell is subsequently perfected. As the sea had become agitated and unfavourable to these investigations, it must at present remain undecided whether the spinous surface corresponds to the dorsal or ventral part of the *Echinus*, and whether the five-limbed figure in the centre of this part belongs to the genital plates with the anus, or, on the contrary, to the dental framework and mouth.

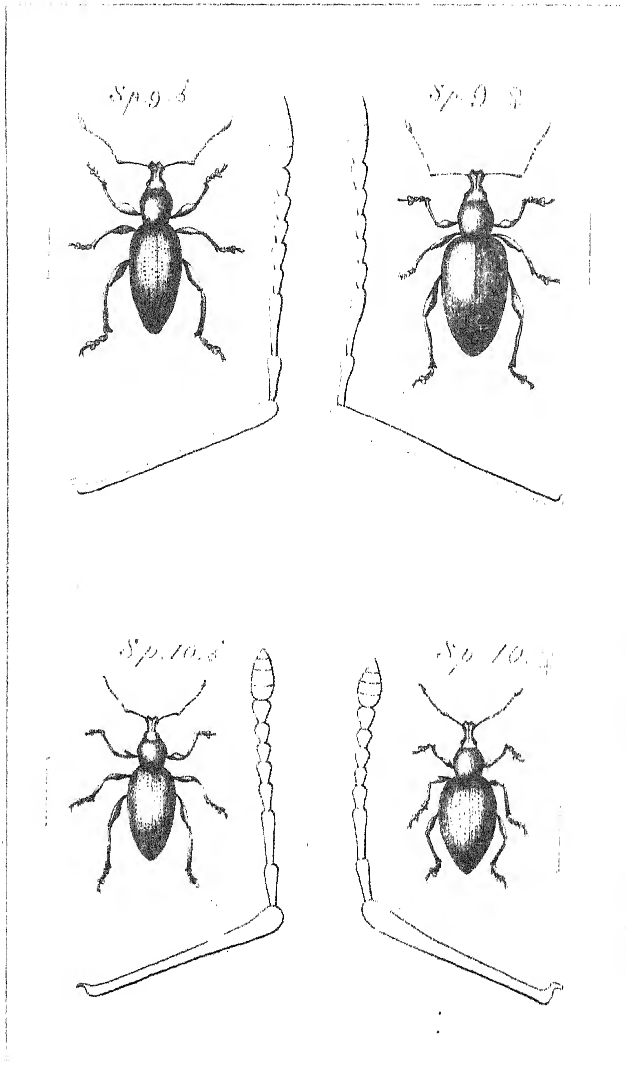
A third species of larva belongs to another genus of spinous Echinodermata, probably also one of the *Echinidæ*. I have not met with this species very frequently, but have traced it furthest in its metamorphosis and up to that point at which the new spinous spherical Echinoderm has lost all traces of the larva.

These larvæ, somewhat larger than the larvæ of the *Ophiuræ*, are

remarkable in possessing, in addition to the four arms which emanate from the margin of the dome, and the other four arms which form the framework of the mouth and œsophagus, two other arms which run backwards and downwards, and also three distinct ones running from the external surface of the dome, thus in all thirteen arms; moreover in the four ciliated plates which exist in the former genus being here entirely absent, and in the arms (excepting the two supernumerary ones behind and below) being extremely long. Of the three peculiar arms on the dome, the odd one forms a more or less elongated, frequently very long stalk on the summit of the dome, as if it were the elongated axis of the animal. It contains a calcareous skeleton, *i. e.* a reticulated axis with three longitudinal ridges. Opposite that foot, upon which this axis rests upon the dome, it subdivides into two calcareous ridges, which descend within the dome and are continued into its lateral arms. The three axes at the dome are not covered with cilia; the ciliated plates are also entirely absent. The cilia covering the lower arms and the arches between them are arranged as in the previous genus. The four extremely elongated main supports of the dome contain reticulated calcareous axes; the calcareous axes of the four equal elongated appendages which form the oral framework and the supernumerary posterior and inferior appendages are simple. The dome is much higher in this species. The distribution of the calcareous ridges from the axes within the dome is exactly similar to that in the previous genus, especially that species in which the dome is round. Some of these larvæ did not exhibit any trace of the disc of the *Echinus*, others had it on the single lesser side of the dome; in others the disc was covered with spines, and between them ambulacral pores and tentacles existed. I have never seen pedicellariæ in this species. The spines exactly resemble those of the previous genus, and become so elevated, that they project beyond the larva and the animal moves them spontaneously. The calcareous skeleton existing in them forms a six-sided prism of lattice-work, the upper ridges of which are elongated beneath the external tegument of the spine into small teeth. The internal arrangement of the axes in the substance of the spine is also six-rayed. The whole surface of the disc is densely covered with these spines, and like the entire larva and its appendages, they are spotted with yellow and brown pigment. Its size is as considerable as that of the previous genus; the length is equal to the third or fourth part of the diameter of the whole body upon which they are situated. It is worthy of remark, that the disc with the spines is longish oval, round, and is considerably more elongated inferiorly than in the previous genus. The disc upon which the spines are situated consists of a calcareous net of lattice-work.

One of these larvæ was once seen in which the axis of the larva had almost entirely disappeared, and in which no further trace of the oral framework remained. The young *Echinus* formed an elongated, spherical, somewhat flattened body without a trace of any Echinoid arms, and in which one half of the surface was completely covered with spines, but the other half was still cutaneous and exhibited traces of the integument of the dome of the larva. For in addition to the pigment spots, several irregular remains of the innermost concealed part of the column and its branches in the dome were visible. The spinous side was convex like a watch-glass, but elongated, and here and there exhibited ambulacral pores, and at the circumference some very large tentacles or feet projected, the distribution of which I could not clearly ascertain. No mouth is visible at the opposite cutaneous portion of the flattened sphere. This may possibly exist at one extremity of the elongated body, but it was impossible to determine this from the opake structure of the body. The length and form of the spines are the same as in the above.

On one occasion an exactly similar body, of equal size, spinous upon one half, elongated, spherical and somewhat flattened (one-fifth of a line long), and free from all larval remains, was observed. Like the previous one it was obtained near the surface of the sea, but it moved upon the glass exactly like an *Echinus,* putting the spines separately into action, and at the circumference extending some large tentacles, by which it held on to the glass. The centre of the spinous surface was free from spines. I recognised a surface divided into five parts and with a pentagonal centre, through the skin spotted with pigment which exists at this part. The side opposed to the spinous half was convex, but still covered merely by the spotted integument, beneath which, remains of the calcareous axes of the larva were still visible. Neither on this occasion was any certain information obtained regarding the mouth, and it remains doubtful whether it existed at either extremity of the elongated, round body. The question is, whether the entire series of developmental phænomena just described belongs to an *Echinus* or rather *Spatangus.* Although the ultimate forms of the larvæ which have been examined are so different, nevertheless it is remarkable that the larvæ of the *Ophiuræ* and *Echini* agree in being formed upon a certain common plan. The larvæ of the *Asteriæ* observed by Sars differ most, but these also agree with the common plan in their bilateral appendages; hence it may be supposed that an analogous starting-point may be found for all the Echinodermata. For this purpose, however, it will be necessary to re-examine the larvæ of the *Asteriæ.* Their internal structure and the position of their mouth are entirely unknown; moreover I have not succeeded in observing from the



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larva of *Echinaster Sarsii*, which is preserved in the museum of M. Christie in Bergen, anything more than what has been described and figured by M. Sars.

At the time when these larvæ have developed the star-fish of the *Asterias*, the arms of the larvæ still being present, their greatest diameter is two-thirds of a line. Two pairs of tentacles are developed in each of the five rows of tentacles. But no trace of aperture can be recognised in the centre of the ventral side of the star-fish. If the oral aperture of the larva, as I suppose, exists between the four arms of the larva, the mouth of the *Asterias* is formed independently of the supposed mouth of the larva. The most central and lowest tubercle, situated between the four other bulbous warts, has a slightly rounded and somewhat basin-shaped aspect. Although these larvæ are absolutely larger than the larvæ of the *Ophiuræ* and *Echini*, nevertheless they appear to contain little or no skeleton within them. From their perfect opacity and uniform red colour, I endeavoured to render their skeleton visible by dissolving the animal parts in caustic potash, but this proceeding did not bring into view any portions of a skeleton.

The supposition of Sars, that the warty appendages of the larva of the *Asterias*, by means of which it adheres to the marsupial cavity of the mother, are subsequently transformed into the madrepore-plates, does not appear to me probable. These appendages are evidently the same as the four symmetrical supports of the body of the larva of the *Echini* and the appendages of *Pluteus*; in both they disappear entirely, without being transformed into any other organ, and the young *Echinus* loses them before the madrepore-plates can be distinguished. Moreover the Echinoid larvæ which I last described possess so many arms on their body and on so many spots which are partly opposite, that a conversion of them into the subsequent madrepore-plates is impossible, on account of the situation which these arms occupy on the anterior, posterior and lateral part of the larva.

XLVI.—*Notes on the genus of Insects* Otiorhynchus, *with descriptions of new species*. By John Walton, F.L.S.

[With a Plate.]

Fam. CURCULIONIDÆ.

Genus Otiorhynchus, *Germ.*, *Schönh.*, *Steph.*, *Curt.*

§ A. *Femora dentate.*

1. *Otiorhynchus Ligustici*, Linn., Mus. Linn., Marsh., Gyll., Steph., Schönh.

Rare, or very local; Mr. Smith found three specimens on Hawley-flat, near Blackwater, Hampshire, in June. Frequently

taken by the late Rev. G. T. Rudd on the walls of his garden, at Kimpton, near Andover. "On sandy banks, near Ventnor, Isle of Wight."—Mr. J. F. Dawson.

2. *Otiorhynchus sulcatus*, Fab., Marsh., Gyll., Steph., Schönh. Very abundant in many localities.

3. *O. picipes*, Fab., Gyll., Germ., Schönh.
— *vastator, et asper*, Marsh., Kirb. MSS.
— *squamiger*, Marsh., Steph. Illustr., Kirb. MSS.
— *notatus, et singularis*, Steph.
— *septentrionis*, Steph. Manual.
— *Marquardtii*, Schönh.
— *Chevrolati*, Schönh. var. minor.

The Fabrician name of *Ot.* (*Curc.*) *picipes* is now very generally adopted for this insect by the principal entomologists of Europe.

I have four British insects returned from Schönherr, two of them named '*picipes*' of Fab. (length 3 lines), and two '*Marquardtii*' of Falderm. (length 4 lines), but I cannot discover any difference between them except that of size. I possess forty British specimens, also returned by Germar, who has put on record the following opinion:—"*Ot. picipes* of Schönh. differs somewhat in its form and clothing, and amongst the varieties (to which there is every kind of transition) are to be found *Curc. squamiger* and *asper* of Marsh., *Marquardtii* of Falderman*."

I have examined the insects in the collection of Mr. Kirby and Mr. Stephens, under the names of *vastator, asper*, and *squamiger* of Marsham, but I am unable to detect a specific difference.

I have now before me a multitude of specimens, collected in the course of several years in various localities in the north and south of England, and have many from Mr. R. N. Greville, who found them in Scotland. I have been induced very closely to examine this numerous series, in consequence of their having been divided into several species, but I must confess my inability to detect a single character on which to found a specific difference; and according to my experience, there is less variation of form and sculpture in these than in any other long series of insects that I have had an opportunity of examining; they vary in length from $2\frac{1}{2}$ to 4 lines, and in breadth from $1\frac{1}{4}$ to $1\frac{3}{4}$ line, and the numerous sizes which intervene between merge insensibly into each other. With reference to the distinguishing characters of *Ot. Marquardtii*, as given by Falderman†, it may be observed, that the largest specimens have the rostrum, antennæ and elytra longer and more robust when compared with the smallest.

* Germ. Stettin Ent. Zeit. 1842, p. 104.
† Schönh. Syn. Ins. vii. p. 358.

Of *Ot. septentrionis* of Herbst I possess several examples from Germar and Chevrolat, but I have not hitherto observed a native specimen in any collection.

Widely distributed throughout Great Britain, occurring almost everywhere from May to October in thick white-thorn hedges, especially in those which have been cut and clipped.

4. *Otiorhynchus rugifrons*, Gyll., Steph., Schönh.
   — *scaber*, Steph. sec. ej. Mus.
   — *Dillwynii*, Steph. Illustr., Kirb. MSS.
   — *rugicollis*, Steph.

This is the true *Ot.* (*Curc.*) *rugifrons* of Gyll. identified by foreign specimens in the collection of Kirby, from Gyllenhal himself.

The sculpture greatly varies; in some specimens the thorax has the dorsal channel very distinct, in others more or less abbreviated, or entirely wanting.

I am of opinion that *Ot. rugicollis* of Steph. (which is represented in his cabinet by one insect) is but a variety of *Ot. rugifrons*, having the thorax channeled, the elytra indistinctly striated, and the anterior femora obscurely denticulated.

Found in the south of England, and in Scotland, but I believe very sparingly; specimens taken on the coast near Little Hampton, Sussex, in August, by Mr. S. Stevens.

5. *O. ovatus*, Linn., Mus. Linn., Fab., Marsh., Gyll., Steph., Schönh.
   — *vorticosus* (Chevr.), Schönh., Steph. Manual.

I possess a specimen from Chevrolat of *Ot. vorticosus* of Schönh., which is decidedly a large variety of this insect.

Very common in hedges about Hampstead in June.

6. *O. pabulinus*, Panz., Germ., Steph. Illustr.
   — *confinis*, Kirb. MSS.

Mr. Kirby separated this insect from the preceding under the name of '*confinis*,' appending the note, '*sine sulcis*;' it is also separated in many cabinets on account of a striking peculiarity in its general habit. Mr. Stephens, after describing it in his 'Illustrations,' adds, "Probably an immature variety of *Ot. ovatus*, but its form and sculpture are slightly dissimilar." He has however sunk it in his 'Manual;' yet I think it has a strong claim entitling it to rank as a distinct species. By far the greatest number differ from *Ot. ovatus* in being piceous, never black, and clothed with brownish pubescence, and by having the thorax shorter in proportion to the breadth, less narrowed posteriorly, less distended at the sides, and thickly tuberculated, not sulcated on the back; the legs shorter, the clava of the femora less robust, with the bifid teeth evidently much shorter and smaller.

I sent specimens to Germar, who remarked in a note to me, "that it also occurs in Germany, and seems to be a good species."

I have found it plentifully among herbage, on a hedge-bank, in a lane behind the Bull Inn, Birch-wood, in June; but not in company with *Ot. ovatus*.

§ B. *Femora edentate.*

7. *Otiorhynchus caudatus*, Rossi, 1792, Schönh.
— *Lima*, Marsh. 1802, Steph. Illustr.
— *bisulcatus*, Steph. Manual, non Fab.

First introduced into our fauna by the late Mr. Marsham, from whose collection Mr. Stephens obtained one specimen. Of its history and locality nothing appears to be known: it is a native of Italy and Greece, and specifically identical with a specimen sent to me by Chevrolat as *Ot. caudatus*.

8. *O. niger*, Fab., Clairv., Germ., Steph. Manual. secund. ejus descr.
— *ater*, Herbst.
— *villoso-punctatus*, Schönh. (♀)

It is sufficiently proved, by the elaborate observations on this and the following species by Professor Germar and M. Schmidt of Stettin, that this is the true "*Curc. niger* of Fab. and Clairv. (*ater* of Herbst), and that it is entirely different from *Ot. niger* of Schönh. (*ater of Gyll.*)*." I possess six insects sent by Germar as the true *Ot.* (*Curc.*) *niger* of Fab., and also a specimen of *Ot. villoso-punctatus* (♀) from Schönherr himself, which are beyond all doubt specifically identical.

The only specimen I have seen which is reputed to be indigenous, and which agrees with my foreign specimens, is in the British Museum unnamed; its locality is unknown; probably found by Dr. Leach on Dartmoor, in Devonshire. According to Germar and Schmidt, it is a native of the mountainous districts of Germany, and found upon *bilberries* and *willows*, and does not occur in Sweden.

9. *O. tenebricosus*, Herbst, Gyll. (♀), Steph., Schönh.
— *morio*, Payk. (♀)
— *niger*, Payk. (♂), Marsh., Schönh., Kirb. MSS.
— *ater*, Gyll. (♂)
— *scrobiculatus*, Schönh. (♂)

In June 1841 I distinctly identified the sexes of this and the following species, by confining living specimens in boxes covered with glass, and I then observed a remarkable sexual dissimilarity in the form and sculpture of the elytra, and in the sculpture of

* Germ. Stettin Ent. Zeit. 1842, p. 103. Schmidt, id. p. 110.

the ultimate segment of the abdomen, which I communicated to Germar and to Chevrolat in February 1842; previously to this, entomological authors (not being aware of the sexual disparities) had either considered the male as a variety, or had separated it as a distinct species.

The male differs by having the elytra narrower, punctate-striate, the punctures distinct or indistinct, the interstices narrow, transversely rugose, and the ultimate segment of the abdomen delicately striated; the female differs by having the elytra broader, transversely rugulose, very obsoletely striated near the suture, and more or less distinctly near the apex, and the ultimate segment of the abdomen punctulated: immature varieties occur with the elytra rufo-piceous, and the colour of the legs varies from testaceous to piceous; the knee-joints and the tarsi are generally of a deeper shade of colour than the other parts, and are occasionally black.

Scarcely any doubt can exist but that Gyllenhal has described the female under the name of *Curc. tenebricosus*, and the male under that of *Curc. ater*, and the words of the description, "segmento anali tenuissime substriato*," as a character peculiar to the male, appear to me conclusive.

I sent fifteen specimens (♂ ♀) of this insect as *Ot. tenebricosus* to Germar, who remarks,—"*Ot. niger* of Schönh. (*ater of Gyll.*) I consider merely as a variety of *Ot. tenebricosus*, from which indeed it apparently differs by its smaller size, and more distinct striæ of the elytra, but it is reunited to it by the most uninterrupted transitions†."

Under the name of *Ot. niger* of Fab. (*ater of Gyll.*) Schönherr has synonymized and characterized the male of this insect as *Ot. scrobiculatus*‡, of which I have specimens from Germar, and which is decidedly a large male variety of *Ot. tenebricosus*.

I may refer to Mr. Curtis's 'British Entomology' for an interesting account of the devastation committed in gardens and nursery-grounds by the larvæ of this and of other species of the genus.

This and the following insect being night-feeders, are found very abundantly in June, after twilight in thick hedges, about Mickleham in Surrey, and in many other counties in the south of England, but it appears to be very rare in the north.

10. *Otiorhynchus fuscipes*, Oliv., Schönh.
— *Fagi*, Chevr. (♀) Schönh.
— *hypolaus et Sacer*, Kirb. MSS.

Oblong-ovate, black, very sparingly pubescent. Head rather

* Gyll. Ins. Suec. iii. p. 292. † Germ. Stettin Ent. Zeit. 1842, p. 103.
‡ Syn. Ins. Suppl. vii. p. 265 (1843).

convex and finely punctured; eyes brown and prominent; rostrum a little longer than the head, porrect, incrassated at the apex, angulated, thickly punctulated above, carinated in the middle, and bifurcate at the apex. Antennæ half as long as the body, black, pilose and pubescent. Thorax narrow, a little longer than broad, somewhat constricted at the base, the margin slightly elevated, moderately dilated, and rounded at the sides before the middle, convex, and minutely punctured and wrinkled above, and distinctly granulated at the sides. Elytra anteriorly not broader than the base of the thorax, the sides gradually dilated to the middle, and from thence attenuated to the apex, convex above, distinctly punctate-striate, the interstices transversely rugose, very nearly glabrous, and the ultimate segment of the abdomen delicately striated. Legs rather long, robust, rufo-ferruginous or rufo-piceous, pubescent; the femora clavate, with the apex piceous or black; the tarsi also piceous or black.—Male. Length $4\frac{1}{2}$ to $5\frac{1}{2}$ lines.

The female differs by having the thorax with the sides dilated and rounded at the middle; the elytra broader, dilated at the sides a little before the middle, and narrowed to the apex; the ultimate segment of the abdomen punctulated. Varieties of the female sometimes occur, although rarely, with the striæ on the elytra indistinct, especially on the disc of each elytron: the colour of the elytra and the legs in both sexes varies as in the preceding species.

There is undoubtedly a very close affinity between this and the preceding insect; nevertheless I am of opinion it is sufficiently distinct, and that there is by far too great a difference between them to admit of their being united into one species; this is a shorter insect, and very generally smaller and less pubescent; but it chiefly differs by having the antennæ in both sexes, with all its articulations, distinctly shorter and stouter; the elytra of the female evidently shorter in proportion to the breadth, and more or less distinctly punctate-striate; the knee-joints in both species are more or less strongly coloured, but too inconstantly to be of any value as a specific difference.

I have applied the name '*fuscipes of Oliv.*' to this insect on the authority of Schönherr, having sent specimens for his examination. I have no doubt that *Ot. Fagi*, of which I possess a specimen from Chevrolat, and with which the description of Schönherr agrees, is but a female variety of this insect, having a smoother surface, and the elytra indistinctly striated.

I forwarded many specimens (♂ ♀) as *Ot. fuscipes* of Oliv. and Schönh. to Germar, who referred them to *Ot. tenebricosus* as varieties.

Most commonly found in company with the foregoing, and in

the same localities; but I once met with it very plentifully in June in the Isle of Portland beneath stones, where there were no hedges, and without finding a single specimen of *Ot. tenebricosus*.

The species figured 9 ♂ ♀, in Pl. XV. and 10 ♂ ♀, exhibit the difference of size and form between the two species comparatively, and between the sexes of each; and also the difference of sculpture of the elytra of the females; the antennæ ♂ ♀ of each species, which are considerably magnified, exhibit their diversity of structure.

11. *Otiorhynchus atroapterus*, De Geer, Gyll., Schönh., Steph. Manual.
   — *ater*, Steph. Illustr.
   — *niger*, Steph. Manual secund. ejus Mus., non Fab.
   — *arenarius*, Kirb. MSS.

My foreign specimens sent by Germar as *Ot. atroapterus* of Gyll. agree with this insect.

Extremely variable in size. Length $3\frac{1}{3}$ to 5 lines. Common in many places on the sandy coasts of Great Britain in June.

12. *O. Monticola* (Dej. Cat.), Germ., Schönh., Steph. Manual.
   — *lævigatus*, Gyll., Steph. Illustr.

This insect is identified as *Curc. lævigatus* by specimens in the collection of Kirby from Gyllenhal.

The striæ of the elytra in some individuals are very distinct, in others indistinct.

Found in Scotland by the Rev. W. Little, Mr. R. N. Greville, and Mr. Weaver.

13. *O. scabrosus*, Marsh., Steph., Schönh., Kirb. MSS.
   Pachygaster crispatus, Dej. Catal.

Rather local, and not very abundant. I once found a number of specimens in a thick white-thorn hedge near Ryde, Isle of Wight, the beginning of August.

14. *O. ligneus*, Oliv., Schönh., Steph. Manual.
   — *scabridus*, Steph. Illustr., Schönh., Kirb. MSS.

I have a specimen from Chevrolat of *Ot. ligneus* of Oliv., which is unquestionably identical with *Ot. scabridus* of Kirb.; Schönherr however has described the latter in his Supplement as a distinct species.

Frequently taken in sandy and gravelly localities, but not very common.

15. *O. maurus*, Gyll., Steph., Curt., Schönh.

Chiefly found in the north of England and in Scotland, but I believe never in any quantity; specimens taken on the sides of Skiddaw, Cumberland, by Mr. Marshall, and likewise in Scotland by the Rev. W. Little and Mr. R. N. Greville.

16. *Otiorhynchus raucus*, Fab., Gyll., Marsh., Steph., Schönh.

Rather uncommon and local. I never took but one specimen, and that on a sandy bank under a hedge near Gravesend; in meadows near Hammersmith, and Hampstead, Mr. S. Stevens.

17. *O.* (? *Trachyphlœus*) *fissirostris* (Schönh. in litt.), Walt.

Oblong-ovate, piceous-black, densely clothed with fuscous, and variegated with cinereous recumbent scales, and rather sparingly with short, erect, fuscous scales. Head black, somewhat long, depressed, subconical, longitudinally ridged and striated all round behind the eyes, the front very deeply furrowed to the middle of the rostrum; eyes small, round, and very prominent; rostrum distinctly shorter and narrower than the head, the apex incrassated, angulated, triangularly emarginated above, deeply excavated between the antennæ, and the lateral margins greatly elevated. Antennæ rather long, testaceous; the scape robust, gradually thickened towards the apex, slightly bent, nearly as long as the flagellum, and squamulose; the funiculus setose, the two basal joints rather long, the second being thinner and a little longer than the first, 3 to 7 obconic, rounded; the club ovate, acute. Thorax black, rather longer than broad in the middle, more narrowed in front than behind, obliquely truncated at the base, impressed on each side anteriorly, moderately dilated at the sides posteriorly, rather convex above, thickly rugose or rugose-punctate, with a dorsal carina more or less abbreviated, and a fovea on each side towards the middle sometimes indistinct; densely clothed with fuscous scales, which are cinereous at the sides. Scutellum scarcely perceptible. Elytra ample, oblong-ovate, piceous-black, anteriorly broader than the base of the thorax, the shoulders rounded, not elevated, moderately expanded at the sides, the apex rounded, a little convex above, regularly punctate-striate, the interstices narrow, alternately elevated; densely clothed with round fuscous scales, which in recent specimens are beautifully variegated with cinereous behind the middle and towards the sides, and rather thickly clothed with short erect fuscous scales. Legs with the femora and tibiæ very stout, rather short and piceous, the former clavate, edentate; densely clothed with fuscous and cinereous scales, and the tarsi short, slender and testaceous. Length $2\frac{1}{2}$ to 3 lines. Immature varieties occur of a ferruginous colour.

The specimen of this insect which I sent to Schönherr for his opinion was returned with the name "*Otiorhynchus* (?) *fissirostris*, n. sp. indescripta." In general habit it resembles my foreign specimens of *Ot. septentrionis*; I have therefore placed it in this genus with an indication of doubt, after the celebrated author of the 'Synonymia Insectorum;' yet it assimilates very closely in

many of its characters to *Trachyphlœus Waltoni*, especially in the clothing, the form and sculpture of the head and rostrum, the robust scape of the antennæ, the short and stout tibiæ, and the short and slender tarsi; and although it chiefly differs in being a larger and longer insect, yet there is a much greater dissimilarity amongst the insects in the genus *Otiorhynchus*, and therefore I think it should be located in that of *Trachyphlœus*.

I obtained specimens from the collection of the late Mr. Millard of Bristol; subsequently found in a gravel-pit on Plumstead Common in June and July by Mr. S. Stevens and Mr. Smith.

PROCEEDINGS OF LEARNED SOCIETIES.

LINNÆAN SOCIETY.

February 2, 1847.—E. Forster, Esq., V.P., in the Chair.

Read an "Account of *Gamoplexis*, an undescribed genus of Orchideous Plants." By Hugh Falconer, M.D., F.R.S., F.L.S. &c. &c.

Trib. GASTRODIEÆ, *R. Br.*

Gen. GAMOPLEXIS, *Falc.*

Perianthium monophyllum, tubulosum, basi ventricosum; limbi breviter 6-lobi segmenta rotundata, antrorsùm (torsione) subsecunda, exteriora æqualia, interiorum posticum (labellum) pedicelli torsione anticum lateralibus paulò majus, cæteroquin consimile. *Columna* elongata, erecta, semiteres, marginato-dilatata, apice tridentata cava, basi anticè incrassata stigmatifera. *Anthera* terminalis, mobilis, decidua, carnosa, bilocularis; loculis parallelis contiguis. *Massæ pollinis* in quovis loculo solitariæ, e lobulis majusculis granulatis laxè cohærentibus conflatæ. *Glandula* aut *caudicula* nulla.—Herba *parasitica* (?) *aphylla, vaginata, rufescens, habitu* Orobanchen *quamdam omninò referens.* Rhizoma *hypogæum, tuberosum, annulatum, spongiosum.* Racemus *elongatus, multiflorus, primò nutans, demùm erectus.* Flores *mediocres, erecti, pallidè stramineo-virides vel ochroleuci.*

GAMOPLEXIS OROBANCHOIDES, *Falc. MSS. cit. in Royle, Illustr.* p. 364, *et in Lindl. Gen. & Spec. Orchid. Pl.* p. 384, *absque charactere aut definitione.*

Hab. in umbrosis humidis inter Montes Emodenses ad alt. circiter ped. 7000; Dhunoultee, Tyne-Teeba, Simla, &c. Floret Julio et Augusto.

After a detailed description of the plant, Dr. Falconer proceeds to point out its affinity both in habit and structure to *Gastrodia*, R. Br., and to *Epiphanes Javanica*, Bl., from both which, however, it is sufficiently distinct in the cohesion of the labellar segment with the tube of the perianthium. It is the only example, so far as Dr. Falconer is aware, hitherto ascertained in the order, of the union of all the divisions of both whorls of the floral envelope into a monophyllous perianthium. Its parasitism is of a peculiar kind; the tuberous rhizoma emits no root-fibres by which to attach itself to other plants, but is itself matted over by their slender rootlets which ramify upon it in every direction slightly imbedded in its surface, to

which they adhere with great tenacity, and especially to the scarious margins of the abortive sheath annuli. This peculiarity was observed in numerous instances, but other cases occurred in which the surface of the tubers presented no such appearance.

February 16.—The Lord Bishop of Norwich, President, in the Chair.

Read an extract from a letter addressed by Captain Sir E. Home, Bart., R.N., to R. Brown, Esq., V.P.L.S., giving an account of the measurement of some of the largest of the New Zealand and Norfolk Island Pines. With reference to the former Sir E. Home quotes from the Journal of Mr. Saddler, Master R.N., who was sent to New Zealand in 1833–4 in command of the Buffalo Store-ship to procure spars for the Navy. The tree which he describes was in a forest near Wangaroa, some miles north of the Bay of Islands. Mr. Saddler says, "On 16th (May 1834) I went to examine a Kauri tree [*Dammara australis*, Lamb.] which Mr. Betts the purveyor in his search through the forest had discovered a few days previous; it is situated about two miles from the river on the steep bank of a ravine. It appeared perfectly sound and healthy, and measured forty-three feet nine inches in circumference, and sixty feet high without a branch. Its head then spread out into forty-one principal branches, some of which were four feet through. It is more than double the size of any tree I have before seen in this country." Sir E. Home adds, that the largest tree of this species that he saw was only eighteen feet eight inches in circumference; but that in Norfolk Island he had measured the largest tree [of *Araucaria excelsa*, Sol.] known to be upon the island and had found it to be 187 feet high, the girth at four feet from the ground fifty-four feet, and at twenty feet from the ground fifty-one feet. This tree is hollow for sixteen feet above the ground, but is in good health.

Read also a memoir "On the Structure and Comparative Physiology of *Chiton* and *Chitonellus*." By Lovell Reeve, Esq., F.L.S. &c. &c.

Mr. Reeve commences his paper by remarking on the paucity of species of *Chitonidæ* known to Lamarck so lately as 1819, and the very large number (amounting to between two and three hundred) now known to inhabit the western coast of South America, the shores of New Holland and New Zealand, and other localities explored by recent voyagers; and states that he is enabled by the kindness of Mr. Cuming and Capt. Sir Edward Belcher to offer a few observations on the structure of *Chiton* and such remarks on *Chitonellus* as, in his opinion, will leave no doubt of their claim to generic distinction. He notices the successive additions made to these genera by Mr. Frembly, by Mr. Cuming, by M. Quoy, by Capt. Belcher in the voyages of the Blossom, the Sulphur and the Samarang (and especially in the latter in company with Mr. Arthur Adams), by the Rev. Mr. Hennah, by Dr. Dieffenbach, by Mr. Earl, by Mr. Ronald Gunn, by Mr. Ince, by Dr. Gould, by Mr. Courthony, and by Prof. Edward Forbes and Mr. M'Andrew; and then enters into an examination of

the views of authors with reference to their affinity, adopting that first promulgated by Adanson and now generally adopted, that they are immediately related to *Patella*. A description of the animal is then given, and the differences between it and the animal of *Patella* pointed out, as well as the modifications to which it is subject in different species. The distinctions between the shells and animals of *Chiton* and *Chitonellus* are more particularly insisted on; and the author proceeds to point out a marked difference in the habits of the two genera. He states, on the authority of Mr. Cuming, that while the Chitons live attached to stones and fragments of shells in deep water, or more frequently under masses of stone and on exposed rocks about low-water mark, the *Chitonelli* dwell in holes and cavities, either of natural formation or bored by other *Mollusca*, into which they thrust themselves by attenuating their bodies in a surprising manner, sometimes turning completely at right angles and at angles again. Those which were only partially imbedded were found to have entered holes too small to contain them, and the posterior part of their bodies remained suspended externally, fat and swollen, and constantly separating from the anterior half when any attempt was made to draw them forcibly from their retreats. These remarks apply to *Chitonellus fasciatus*, collected by Mr. Cuming in the Philippine Islands in great abundance and of extraordinary dimensions, extending frequently to a foot or more in length. Capt. Sir E. Belcher and Mr. Adams collected the same species in the Korean Archipelago, where they were found in company with Chitons and noticed to be of locomotive habits; the *Chitonellus* seeking retirement in a hole or cavity, but crawling away from its attachment on being disturbed, at about the pace of the common garden snail.

For these reasons, although Mr. Reeve does not regard the other subdivisions proposed in the genus *Chiton* as of greater value than sectional, he considers *Chitonellus* as entitled to rank equally with *Chiton* in its most extended form, being in his opinion clearly distinguished both in structure (as regards the condition of the mantle and its system of calcification) and in habit.

March 2.—The Lord Bishop of Norwich, President, in the Chair.

Read "Notes on the seals of Linnæus." By the Baron d'Hombres Firmas. Communicated by the Secretary.

In these notes, intended to form part of the preliminary matter prefixed to the correspondence of Linnæus with his uncle, Boissier de Sauvages, which the Baron is about to print for private distribution, an account is given of the seals employed by Linnæus in that correspondence, and of some others with which M. d'Hombres Firmas has become acquainted from other sources. Of all of these he gives figures, adding the armorial bearings of Linnæus as designed by himself, and as altered to suit the rules of heraldry by the Chancellor De Fitas, the seal of the Linnean Society, and the reverse of a medal struck in 1758, in honour of Linnæus, by order of Count Tessin, Marshal of the Diet.

Read also a paper "On the Impregnation of *Dischidia*." By the late William Griffith, Esq., F.L.S. &c. &c. Communicated by Robert Brown, Esq., V.P.L.S.

In this paper, dated "Mergui, March 7, 1835," Mr. Griffith details a series of observations made in January of that year on *Dischidia Rafflesiana*, Wall., and confirmed (with the exception of those relating to the development of the ovule) by the examination of another species, apparently allied to *D. Bengalensis*, Colebr.

Mr. Griffith commences by a description of the progress of the ovula from their first appearance as mere rounded elevations on the placenta. The first change consists in a narrowing towards the base, which afterwards puts on the appearance of a funiculus, and at the same time a rounded rather shallow cavity appears on the upper edge of the ovulum close to the funiculus. The further changes take place rapidly; the rounded cavity assumes the appearance of a deep fissure with raised margins extending from the base of the ovulum, close to the funiculus, along the upper margin of the ovulum for about one-fourth of its length. This fissure gradually lengthens; its lips become more expanded, and a small indistinct grumous-looking mass becomes visible in the central line and towards the apex of the ovulum, which is the first rudiment of the nucleus, or of the cavity within which the future embryo is to be developed, and which becomes subsequently more distinct, and frequently assumes a rounded form. In the perfect ovule the fissure is very large, extending longitudinally from the base of the funiculus for about one-third of the length of the convex upper margin of the ovule; its lips are gaping, and it is of considerable depth, gradually narrowing towards its fundus. The grumous mass is now very distinct and the first indications of an excavation around it are appreciable. When no impregnation has taken place, in flowers that have passed their meridian, the excavation is enlarged, the grumous mass is more irregular, and it frequently appears to be broken up, the component parts being irregularly grouped together.

The partial closing of the corolla of *Dischidia* by the connivence of its divisions, and the short hairs with which those divisions are furnished internally in *D. Rafflesiana*, induced Mr. Griffith to regard foreign agency as inapplicable in determining the escape of the pollinia from their anthers, and to believe that impregnation in any given flower is in this genus the result of the action of its own pollinia. The pollinia are erect, have no diaphanous margin, and dehisce along that margin which is internal with regard to the cell of the anther, and which presents no appreciable difference of structure, but corresponds with the margin of dehiscence of the pendulous pollinia first noticed by Mr. Brown. The base of the stigma is slightly papillose in *D. Rafflesiana*, and more evidently so in the other species; and the fissures of communication are open in the former, but closely approximated in the latter. In neither has Mr. Griffith seen the pollinia engaged in these fissures, but they are either caught by the processes of the corona or fall to the fundus of the corolla; and in whatever situation they emit their boyaux, the cord formed

by the aggregation of the latter always engages itself in the nearest fissure where it becomes more opake and grumous. The cord then passes upwards to the base of the stigma, along which it is reflected until it reaches the union of the stigma with the styles, at which place it dips into one of them, or rarely both, and proceeds downwards to the placenta, causing a slight discoloration of the adjoining tissue. The boyaux then separate and proceed in every direction among the ovula, to which they become firmly attached. They contain much granular matter which has a strong tendency to accumulate towards their termination. Mr. Griffith states that he has observed an oscillatory motion, but no motion of ascent or descent, of the contained granules. The tubes are simple and one appears to be allotted to each ovulum, to which it remains applied for some time, invariably passing in at the centre of the fissure and adhering so firmly that they break across rather than separate. Mr. Griffith was unable to demonstrate their termination internally by actual dissection, but in one instance he observed the boyau to terminate about the fundus of the fissure in a cul-de-sac, which was crowded with granules. Whatever the function of these granules may be, similar bodies exist in the cellular tissue of the ovula both before and after the application of the tubes, and the majority certainly disappear before the tubes reach the ovula.

No immediate change appears to be produced in the ovula by the application of the tubes; but some time afterwards the excavation appears to enlarge and extend towards the point of insertion of the tube; and this action is continued until the whole of the granular mass disappears and the chief part of the ovulum is occupied by the now empty excavation. No further appreciable change, except in size, takes place for some time, and the rudiments of the coma are even visible before any part of the embryo appears to be formed.

March 16.—The Lord Bishop of Norwich, President, in the Chair.

Mr. Ward, F.L.S., exhibited specimens of several Ferns collected in Ireland, including *Trichomanes speciosum* (referred to *Tr. radicans*, Hedw. fil.) found in a new station on the Toomies mountain, Killarney; *Hymenophyllum Tunbridgense*, of more than double the size of any specimens to be found at Tunbridge Wells; and a monstrous and singularly divided variety of *Asplenium Filix Fœmina*, found about twenty years ago in Connemara, and sent to the Botanic Garden at Dublin, where it maintains its character when grown from the sporules, which are freely produced.

Read a "Note on *Samara læta*, L." By G. A. Walker Arnott, Esq., LL.D., F.L.S., Regius Professor of Botany in the University of Glasgow.

In this note Dr. Arnott gives a minute account of the history of the genus *Samara*, and of the errors of various authors in regard to it, originating partly in Linnæus's own misquotation as a synonym of Burm. Thes. Zeyl. t. 31, which represents a species of *Memecylon*; partly in Jussieu's reference of the genus to *Rhamneæ*, afterwards

corrected by himself, but which correction seems to have escaped observation; and partly in the assumption that the *Samara læta* of Swartz, referred to in his 'Flora Indiæ Occidentalis,' must therefore be a plant of the West Indies. With regard to the affinities of the genus, he notices Mr. Brown's reference to *Myrsine* of the three species added by Swartz, Solander and Willdenow, and also Jussieu's suggestion that *Samara* is related to *Myrsine*, both published in 1810. A detailed examination of the three specimens of *Samara læta* preserved in the Linnean Herbarium, and of three specimens from China referred to that species in the Banksian Herbarium, follows; and he concludes from this examination that *Samara*, L., is identical with *Choripetalum*, A. DeC., which is scarcely distinguishable from *Embelia*, L., except in the quaternary instead of quinary division of the flower, although perhaps the æstivation may also slightly differ. The following are the characters which Dr. Arnott gives of the species hitherto known to him :—

1. *S. læta*, floribus corymbosis, bracteis pedicello duplò brevioribus, petalis intùs glabris, foliis membranaceis planis.
Samara læta, *L.*, *Sw.* *&c.*
Hab. in Chinâ.

2. *S. undulata*, floribus racemosis, bracteis pedicello multò brevioribus, petalis intùs glabris, foliis membranaceis undulatis.
Myrsine? undulata, *Wall. in Roxb. Fl. Ind.* i. p. 299.
Choripetalum undulatum, *Alph. DeC. in Linn. Trans.* xvii. p. 131.
Hab. in Nepaliâ.

3. *S. viridiflora*, floribus racemosis, bracteis pedicello duplò brevioribus, petalis subacutis intùs subvelutinis, foliis subcoriaceis.
Choripetalum viridiflorum, *Alph. DeC. Prodr.* viii. p. 88.
Hab. in Javâ.

4. *S. aurantiaca*, floribus spicato-racemosis, bracteis pedicellum ferè superantibus, petalis intùs velutinis, foliis coriaceis.
Myrsine? aurantiaca, *Wall. in Roxb. Fl. Ind.* i. p. 300.
Choripetalum aurantiacum, *Alph. DeC. in Linn. Trans.* xvii. p. 131.
Hab. in Peninsulâ Indiæ Orientalis, ad Quilon.

5. *S. atropunctata*, floribus racemosis, bracteolis pedicello florigero duplò longioribus, petalis obtusis intùs glabris, foliis coriaceis.
Hab. in Peninsulâ Indiæ Orientalis, ad Quilon.

Of the stability of this latter species, however, although apparently distinct from *S. aurantiaca* in the characters given, Dr. Arnott entertains some doubts.

April 6.—R. Brown, Esq., V.P., in the Chair.

Read a "Note on *Cryptophagus cellaris*, Payk." By George Newport, Esq., F.R.S., F.L.S. &c.

The author states that in his first memoir on *Meloë* he described a larva, of which he had found three specimens in the cell of *Anthophora retusa*, and which, although they were of small size, he then thought might ultimately prove to be the young of *Meloë*, at a period of growth between that in which it is now known to come from

the egg, and that in which he has found it, immediately before it changes to a nymph. He did not however describe them as actually the young of *Meloë*, and he now finds that they belong to another family, the *Engidæ*.

The author then describes these larvæ more minutely, and states that having kept them in a glass vessel partly filled with dry clay and a cell of *Anthophora retusa* which contained a nymph, he found that the larvæ constantly sheltered themselves beneath it, although they did not attempt to prey on it, but fed on the rejectamenta voided before it underwent its change. The larvæ continued in this state till the beginning of January, when each specimen quitted the cell of the bee, and excavated for itself a burrow in the clay in which it assumed the nymph state. The nymph closely resembled that of *Diaperis Boleti* in its general appearance.

At the end of February each specimen assumed the imago state, but continued feeble, and remained in its burrow until the eighth of March, when it came forth and proved to be *Cryptophagus cellaris*, Payk.

ZOOLOGICAL SOCIETY.

March 23, 1847.—Wm. Yarrell, Esq., Vice-President, in the Chair.

On eight new species of Australian Birds; and on Anthus minimus, Vig. and Horsf., as the type of a new genus Chthonicola, Gould. By John Gould, F.R.S.

Artamus albiventris. *Art. loris, spatio infra oculum, et mento, atris; capite, collo, et dorso superiore, fusco-griseis; pectore et abdomine pallidè griseis, colore griseo in tectricibus caudæ inferioribus albo mergente; tectricibus caudæ superioribus, caudâque, nigris; tertiâ parte apicali rectricum omnium, intermediis duabus exceptis, albâ.*

Lores, space beneath the eye and the chin deep black; head, neck and upper part of the back brownish grey; lower part of the back and the wings dark grey, becoming gradually deeper towards the tips of the feathers; primaries and secondaries narrowly edged with white at the tip; under surface of the wing white; ear-coverts, chest, and abdomen pale grey, passing into white on the under tail-coverts; upper tail-coverts and tail black; the apical third of all but the two middle feathers white; irides dark brown; bill yellowish horn-colour, becoming black at the tip; feet blackish brown.

Total length, 7 inches; bill, $\frac{7}{8}$; wing, $4\frac{7}{8}$; tail, $2\frac{3}{4}$; tarsi, $\frac{3}{4}$.

Hab. Darling Downs, New South Wales, &c.

Remark.—This species differs from the *A. cinereus*, to which it is most nearly allied, in the white colouring of the abdomen and under tail-coverts. Two specimens have come under my notice, both of which were killed by Mr. Gilbert, one on the Darling Downs, in New South Wales, and the other at Peak-range Camp, one of the stations so named by Dr. Leichardt during his expedition from Moreton Bay to Port Essington.

ACANTHIZA APICALIS. *Acan. plumis in fronte cervinis, fusco marginatis; caudâ latâ fasciâ fusco-nigrâ prope apicem transversim ornatâ, apice ipso albo; tectricibus caudæ superioribus rufo tinctis.*

Feathers of the forehead deep buff, edged with dark brown; all the upper surface, wings and tail light olive-brown; tail crossed near the extremity with a broad and distinct band of brownish black, and largely tipped with white; upper tail-coverts tinged with rufous; throat and chest greyish white, each feather margined with black, giving that part a mottled appearance; flanks, abdomen and under tail-coverts pale buff; irides light red; bill, legs and feet dark brown.

Total length, 4 inches; bill, $\frac{1}{2}$; wing, 2; tail, 2; tarsi, $\frac{7}{8}$.

Hab. Swan River, Western Australia.

Remark.—Distinguished from *A. diemenensis*, *A. pusilla*, and *A. Ewingii*, to all of which it is nearly allied, by its large size, by its larger and rounder tail, by the broad and distinct band of black which crosses the tail-feathers near their extremities, and by their being largely tipped with white.

CYSTICOLA ISURA. *Cys. colli lateribus, nuchâ, et uropygio pallidè rufis; vertice, dorso, secondariisque, saturatè brunni-nigris, singulis plumis stramineo marginatis, et latâ fasciâ atrâ transversim prope apicem infra ornatis.*

Sides and back of the neck and rump pale rufous; crown of the head, back and secondaries deep brownish black, each feather margined with buff; tail dark brown, margined with buff, and crossed on the under side near the tip with a broad conspicuous band of black; under surface deep buff, becoming paler on the chin and centre of the abdomen; bill brown; feet yellowish brown.

Total length, 4 inches; bill, $\frac{1}{2}$; wing, $1\frac{3}{4}$; tail, $1\frac{1}{2}$; tarsi, $\frac{3}{4}$.

Hab. Southern coasts of Australia.

Remark.—Distinguished from the other members of the genus by the shorter and more truncated form of its tail, which has suggested the specific term assigned to it.

CHALCITES OSCULANS. *Chal. capite, corpore superiore, alisque, nitente olivaceo-fuscis, colore eodem in humeris primariisque saturatiore, sed in tectricibus caudæ superioribus albicante; caudâ intensè olivaceo-fuscâ, plumâ quâque ad apicem albâ; pectore et abdomine pallidè cinnamominis.*

Head, all the upper surface and wings glossy olive-brown, becoming darker on the shoulders and primaries, and fading into white on the upper tail-coverts; tail dark olive-brown, each feather tipped with white, and the lateral one on each side crossed on the inner web with five bars of white; ear-coverts black, encircled with white; under surface of the wing, throat, breast and abdomen pale cinnamon-brown, fading into white on the under tail-coverts; bill brown; feet olive-brown.

Total length, $7\frac{1}{2}$ inches; bill, $\frac{7}{8}$; wing, $4\frac{5}{8}$; tail, $3\frac{7}{8}$; tarsi, $\frac{3}{4}$.

Hab. New South Wales.

Remark.—I have applied the term of *osculans* to this species, be-

cause in it are united in a remarkable degree the characters of the genera *Cuculus* and *Chalcites*; but as those of the latter genus predominate, I have retained it therein.

Synoïcus diemenensis. *Syn. fronte, loris, et mento griseo-albis, stramineo tinctis; vertice saturatè brunneo, medio lineâ stramineâ notato; omni corpore superiore fasciis irregularibus transversis griseis, nigrisque, castaneisque, vario; mediis plumis lineâ griseo-albâ ornatis.*

Forehead, lores and chin greyish white, tinged with buff; crown of the head dark brown, with a line of buff down the centre; all the upper surface irregularly marked with beautiful transverse bars of grey, black and chestnut, each feather with a fine stripe of greyish white down the centre; primaries brown, mottled on their external edges with greyish brown; all the under surface greyish buff, each feather with numerous regular somewhat arrow-head-shaped marks of black, and many of them with a very fine line of white down the centre; bill blue, deepening into black at the tip; irides orange; feet dull yellow.

Total length, $8\frac{1}{2}$ inches; bill, $\frac{3}{4}$; wing, $4\frac{1}{2}$; tarsi, $1\frac{1}{8}$.

Hab. Van Diemen's Land.

Remark.—Nearly allied to *S. australis*, but of a much larger size and with the markings of the upper surface more numerous and varied.

Synoïcus sordidus. *Syn. saturatè fuscus minutè nigro maculatus; mediis plumis corporis superioris inferiorisque latâ fasciâ griseo-cæruleâ longitudinaliter ornatis.*

General plumage dark brown, minutely freckled with black, each feather of the upper and under surface with a broad stripe of bluish grey down the centre; feathers of the head and back of the neck with a spot of blackish brown at the tip, those down the centre of the head and a few of the back feathers with white shafts; chin buff; flank-feathers with an arrow-head-shaped mark of black near the tip.

Total length, 7 inches; bill, $\frac{5}{8}$; wing, $3\frac{3}{4}$; tarsi, $\frac{7}{8}$.

Hab. South Australia.

Remark.—With the exception of *S. sinensis*, this species is the least of the genus yet discovered; it moreover differs from them all in the absence of any varied markings, in lieu of which all the feathers of the upper surface have a broad bluish grey stripe down the middle.

Porzana leucophrys. *Por. fasciâ à mandibulæ superioris basi ad angulum oculi posticum ductâ griseo-albâ; maculâ latâ atrâ ab oculo ad rictum extensâ; nuchâ, corpore superiore, caudâque, fusco-nigris; capitis, colli, et pectoris, lateribus griseis; mento, et medio abdomine albis.*

From the base of the upper mandible to the posterior angle of the eye a streak of greyish white; from the eye to the gape a broad patch of deep black; crown of the head brownish black; back of the neck, upper surface and tail brownish black, each feather margined with pale reddish, the latter colour becoming very conspicuous on the wing-coverts and scapularies; wings pale brown; sides of the head,

neck and breast grey; chin and centre of the abdomen white; flanks and under tail-coverts rufous; upper mandible reddish brown; tomia of both mandibles tile-red; legs and feet oil-green, blotched with light ash-colour.

Total length, $6\frac{1}{2}$ inches; bill, 1; wing, $3\frac{1}{2}$; tail, 2; tarsi, $1\frac{3}{8}$.

Hab. Port Essington and Northern Australia.

Remark.—This bird differs from every other species of the genus inhabiting Australia, in having a superciliary stripe of white, in the black colouring of the lores, and in the olivaceous tint of the plumage.

Plotus novæ-hollandiæ. *Plot.* (Mas) *gulâ figurâ sagittæ cuspidis albâ notatâ; latâ fasciâ albâ à mandibularum basi quatuor unciis in colli latera extensâ; scapularibus lanceolatis, lanceolatâ maculâ in medio, et caulibus atris ornatis.*

Male.—An arrow-head-shaped mark of white on the throat; a broad stripe of the same colour commences at the base of the mandibles, extends for about four inches down the sides of the neck, and terminates in a point; head, neck and all the upper surface of the body greenish black, stained with brown and with a patch of deep rusty red in the centre of the under side of the throat; under surface deep glossy greenish black; wings and tail shining black; all the coverts with a broad stripe of dull white, occupying nearly the whole of the outer and a part of the inner web, and terminating in a point; scapularies lanceolate in form, with a similar shaped mark of white down the centre, and with black shafts, the scapular nearest the body being nearly as large as the secondaries, and having the outer web crimped and the inner web with a broad stripe of dull white close to the stem; the secondaries nearest the body with a similar white stripe on the outer web, close to the stem; centre tail-feathers strongly and the lateral ones slightly crimped; orbits naked, fleshy, protuberant, and of a yellowish olive, mottled over with brown specks; irides of three colours, the ring nearest the pupil being dull orange-buff; to this succeeds another of marbled buff and brown, and to this an outer one of orange-buff; naked skin at the base of the lower mandible wrinkled and yellow; upper mandible olive, under mandible dull yellow, both becoming brighter at the base; feet yellowish flesh-colour, becoming brown on the upper part of the outer toes.

Female.—Upper surface blackish brown, each feather margined with greyish white; under surface buffy white. In other respects similar to the male.

Total length, 36 inches; bill, 4; wing, $13\frac{1}{2}$; tail, 9; tarsi, 2.

Hab. The rivers of the whole of the southern coast of Australia.

Remark.—Very nearly allied to the *Plotus* inhabiting Java, but distinguished from it by the shortness of the scapularies and by its larger size.

Mr. Gould also exhibited to the Meeting a specimen of the *Anthus minimus* of Messrs. Vigors and Horsfield, and having pointed out the particulars in which it differs from the members of the genus *Anthus*, proposed to constitute it the type of a new genus, with the following appellation and characters:—

CHTHONICOLA, nov. gen.

Char. gen.—*Rostrum* breve, a basi descendens, mandibulâ superiore ad apicem lævè dentatâ, in lateribus compressâ. *Tomiæ* introrsum curvatæ. *Alæ* concavæ, primario primo perbrevi, tertio, quarto, quinto et sexto longitudine æqualibus. *Tarsi* moderati. *Digiti* breves, posticus medio brevior. *Ungues* anteriores magis quam in "*Antho*" curvati.

Gen. char.—Bill short, gradually descending from the base; the upper mandible slightly notched at the tip, compressed laterally; tomia curving inwards; wings concave; the first primary very short, the third, fourth, fifth and sixth nearly equal and the longest; tail slightly concave, and all the feathers of an equal length; tarsi moderately long; toes short, the hinder toe somewhat longer than the middle one; front claws more curved than in the genus *Anthus*.

DESCRIPTION OF A NEW SPECIES OF AMPHIOXUS FROM BORNEO. BY J. E. GRAY, ESQ., F.R.S., ETC. ETC.

Capt. Sir Edward Belcher having most kindly sent to the British Museum the various species of reptiles, worms, &c. in spirit which had been collected during the voyage of H.M.S. Samarang, I hasten to lay before the Society the description of what appears to be a new species of Lancelet (*Branchiostoma*, Costa = *Amphioxus*, Yarrell), premising that I have sent a second specimen to Dr. Clarke, R.N., of Haslar, who has kindly promised to send me some anatomical details of it, which shall be communicated to the Society as soon as they arrive.

I may remark that the specimen from Borneo very much resembles in size the specimen which Mr. Couch obligingly sent to me from Cornwall, and, like it, is more silvery and considerably larger than numerous specimens I have received through the kindness of Dr. Kolliker from Naples. This difference in colour may arise from the Naples specimens having been placed in stronger spirits; but it gives the Cornish and the Borneon specimens much more the resemblance of Annelides, which generally have this metallic iridescent silvery hue.

The resemblance of the Borneon to the Cornish specimen is so striking, that it is very difficult to draw a distinction between them with neatness or brevity; yet they appear to my eye sufficiently different to induce me to regard them as distinct species, which the great geographical distance between their habitats renders probable.

Amphioxus Belcheri.—The Borneon Lancelet appears rather thicker and more convex on the sides than *Amph. lanceolatus*, and the convex ridge which occupies the place of the dorsal fin appears higher and more closely divided by internal transverse septa than in that species, and these septa appear more numerous. I have not been able to observe any beards on the margin of the mouth, which is thickened and rounded; but this may arise from the specimen not being in good condition, especially in this part where it has been injured by the spines of a Spatangus which was in the same bottle.

Hab. Borneo, at the mouth of the river Lundu.

I may remark, that the comparison of these Lancelets from Naples, Cornwall and Borneo has induced me to think that most probably the species from Naples may be distinct from the Cornish. All our specimens are smaller and more opake; the beards of the mouth appear finer; and the dorsal ridge above referred to appears comparatively smaller, even making allowance for the difference in the size of the specimens.

A few Remarks on the Geographical Distribution of Birds in the West Indies. By William Denny, Esq.

Humboldt, Vigors, Swainson and other eminent naturalists, lament the defective state of knowledge respecting the zoology of the West Indies. The Flora of Jamaica has been often successfully explored; the geology of a great portion has been investigated by De la Beche; the ornithology and entomology however remain nearly in the state in which they were left one hundred years since by Sir Hans Sloane. In all the departments of the natural history of the Antilles much still remains to the inquirer, but in zoology he has an almost unexplored field for his researches. The region of Tree-ferns has been left unexamined for the botanist, the western half of Jamaica for the geologist; but with the exception of about sixty species of birds noticed by Sloane and Browne, the entire ornithology is unknown*, including all the species peculiar to the mountainous districts.

About thirteen years since an attempt was made to send out a party of naturalists to examine the animals and productions of Jamaica, but it failed; and had the party reached those shores, I doubt that their researches would have thrown much additional light on zoology. The insalubrious nature of the climate in the low grounds, the excessive heat, and many other causes, would probably have rendered their exertions fruitless. The naturalist must alike be familiar with the inhabitants of the deadly swamp and the pathless mountain; he must brave the tropical heat and mountain cold, and the sudden transitions of temperature. It is only those inured to the climate by long residence, and who have had fortitude to resist its debilitating effects, or those born in the country whose habits are active and pursuits congenial, that can sustain these difficulties and dangers.

Placed at nearly equal distance from North and South America, it might be supposed that nearly an equal number of the species of each division of that continent might be found in Cuba and Jamaica. This supposition is not however fully borne out by observation, although from our knowledge of the ornithology of Terra Firma being extremely imperfect, it is difficult to render a conclusion free from error. It will hereafter appear, that of the birds of Jamaica, one-half are common to North America, while hardly one-fifth are also found in the southern region of the New World.

Of those species common to the islands more immediately under

* This want of information has been reduced very considerably at the present moment by the appearance of Mr. Gosse's work 'On the Birds of Jamaica.'

notice, and Mexico, a great identity of genera and species might be expected. Placed in the same degree of latitude, possessing many similar features in scenery, elevation, temperature and productions, with sufficient facility of communication for the feathered tribes, they might, without actual examination, be considered as constituting the same animal kingdom or province. But Mexico is united to the southern portion of the continent by land, while Jamaica is separated by leagues of sea, a great natural impediment to families possessing feeble powers of flight.

Wilson remarks that "in passing along the chain of the Bahamas, towards the West Indies, no great difficulty can occur from the frequency of these islands, nor even to the Bermudas, which are said to be six hundred miles from the nearest point of the continent." Whether this facility of communication between the United States and the greater Antilles may be sufficient to account for the greater preponderance of species from this division than from the southern, may by some be doubted; but it may be as well to bear in mind that the Raptores and long-winged families of the Insessores are common both to the States and Antilles, while the short-winged families are nearly all distinct.

There are many features of resemblance between the ornithology of Mexico and the great Antilles. Nearly all the birds common to the former and the United States are likewise found in Jamaica, while the latter possesses species supposed by Mr. Swainson to be peculiar to Mexico, and I believe that further investigation will tend to show that the distribution of species is very similar.

I will only make one remark, that many birds supposed to belong to the States are in reality tropical or West Indian, and merely very transient and in numerous instances accidental visitors to North America. For example, the *Columba Zenaida* is very rare in the States, while in Jamaica it is the most abundant species in the island, and was mentioned by Sir Hans Sloane.

I will pass over the migration of birds to and from the West Indies, as well as the influence that natural families of plants appearing in distant countries may have in producing it, as being beyond the limits which I have assigned to myself in these observations. I will now give a catalogue of all the birds that I have met with during a sojourn of six years in Jamaica, during which time my leisure hours have been constantly devoted to pursuits connected with natural history.

Birds common to Jamaica, Cuba, and the United States.

Land Birds.

1. Cathartes aura.
2. Buteo borealis.
3. Circus americanus.
4. Haliaëtus niger.
5. Accipiter pensylvanicus.
6. Pandion haliaëtus (? carolinensis.)
7. Strix flammea.
8. —— asio.
9. Hirundo fulva.

10. Caprimulgus carolinensis.
11. —— americanus.
12. Alcedo alcyon.
13. Tyrannus intrepidus.
14. Muscicapa ruticilla.
15. —— virens.
16. —— fusca.
17. —— crinita.
18. Vireo-olivacea.
19. Merula minor.
20. —— mustelinus.
21. Orpheus polyglottus.
22. Sciurus aurocapillus.
23. Trichas personatus.
24. Sylvicola pusilla.
25. —— americana.
26. —— canadensis.
27. —— minuta.
28. —— pensilis.
29. Sylvicola coronata.
30. —— maculosa.
31. Vermivora solitaria.
32. Fringilla tristis.
33. —— Zevanna.
34. Dolichonyx oryzivorus.
35. Sturnella magna.
36. Icterus versicolor.
37. Corvus ossifragus.
38. Picus carolinensis.
39. Cuculus carolinensis.
40. Certhia maculata.
41. Columba leucocephala.
42. —— passerina.
43. Ortyx marylandus.
44. Tyrannula Saya.
45. Columba carolinensis (Cuba only).

Birds of Jamaica and Cuba observed in Terra Firma, but unknown in North America.

1. Sarcoramphus papa (accidental).
2. Polyborus brasiliensis.
3. Circus rutilans.
4. Muscicapa ferox.
5. Icterus dominicensis.
6. Trochilus furcatus.
7. Crotophaga ani.

Birds peculiar to the West Indies, and seldom if ever detected in the United States or Terra Firma.

[These birds have been observed in Jamaica and Cuba.]

1. Accipiter fringilloides, *Vig.*
2. Falco sparveroides, *Vig.*
3. Hirundo thalassinus, *Sw.*
4. —— Tapera, *Linn.*
5. —— albicollis, *Vieil.*
6. —— melanogaster, *Sw.*
7. —— (undetermined).
8. Caprimulgus jamaicensis, *Bris.*
9. Todus viridis, *Linn.*
10. Merula jamaicensis, *Linn.*
11. —— fusca vel leucophthalma (undescr.).
12. —— dominicus, *Linn.*
13. —— rubripes, *Temm.*
14. Sylvicola dominica, *Linn.*
15. Pyrrhula nigra, *Linn.*
16. —— collaris, *Vig.*
17. Fringilla Zena.
18. —— noctis, *Linn.*
19. —— jamaicensis, *Linn.*
20. —— bicolor, *Linn.*
21. —— lepida, *Linn.*
22. Carduelis mexicana, *Sw.*
23. Icterus bonano, *Linn.*
24. —— cucullatus, *Sw.*
25. —— mexicanus, *Linn.*
26. —— brasiliensis, *Linn.*
27. —— mexicanus*.
28. —— baritus, *Linn.*
29. Leistes humeralis, *Vig.*
30. Corvus jamaicensis, *Linn.*
31. Trogon temnurus, *Temm.*
32. Psittacus leucocephalus, *Linn.*
33. —— æstivus, *Linn.*
34. Psittacara nana, *Vig.*

* Icterus xanthornis.

35. Picus carolinus, *Linn.*
36. —— percussus, *Vig.*
37. Colaptes auratus, *Vieil.*
38. —— Fernandina, *Vig.* (Cuba only).
39. —— superciliaris, *Temm.* (Cuba).
40. Cuculus vetula, *Linn.*
41. —— pluvialis, *Gm.*
42. Certhia flaveola, *Linn.*
43. —— maculata, *Wils.*
44. Cynanthus polytmus, *Linn.*
45. —— minimus, *Linn.*
46. Lampornis mango, *Linn.*
47. Columba Caribbæa, *Gmel.*
48. —— inornata, *Vig.*
49. Columba montana, *Linn.*
50. —— jamaicensis, *Linn.*
51. —— leucoptera, *Linn.*
52. —— minuta, *Linn.*
53. —— sylvestris?
54. —— martinica, *Linn.*
55. —— Zenaida, *Buon.*
56. —— cyanocephala, *Linn.* (Cuba only).
57. { Numida meleagris, *Linn.* / —— maculipennis, *Sw.* }
58. Tanagra gularis.
59. Sitta jamaicensis (not of Sloane or Browne).
60. Pipillo maculata, *Sw.*

Note.—Many of the above species have not been referred to modern genera on account of several of them being proposed from data so different that it is difficult for a Transatlantic naturalist to select from such eminent authorities as Vieillot, Swainson, Buonaparte, Cuvier or Temminck. When no authority is given, the nomenclature is that of Wilson.

Water Birds.

The following species, with one or two exceptions, seem equally distributed over the United States, Mexico, Jamaica and Terra Firma, so that no division of them will be necessary.

Ardeidæ.

Ardea virescens.
—— ludoviciana.
—— cærulea.
—— abba.
—— exilis.
—— candidissima.
—— herodias.
Nycticorax violacea.
—— Gardenii.
Botaurus minor.
Platalea ajuga.
Phœnicopterus ruber (Amer.).

Tantalidæ.

Ibis rubra.
—— alba.
Tantalus loculator.

Scolopacidæ.

Scolopax gallinago (Amer.).
Scolopax grisea.
—— minor.
Totanus macularius.
—— chloropygius.
—— flavipes.
—— semipalmata.
Tringa rufescens.
—— pectoralis.
—— minutella.
—— pusilla.
Numenius longirostris.

Charadriadæ.

Charadrius semipalmatus.
—— vociferus.
—— apricarius.
—— monnellus.
—— pluvialis.
—— melodus.
Squatarola cinerea.
Himantopus melanopterus.

Rallidæ.

Rallus minutus.
—— jamaicensis.
—— virginianus.
Aramus scolopaceus.
Parra Jacana.
—— variabilis.
Gallinula Galatea.
—— Martinica.

NATATORES.

Anatinæ.

Dendronessa sponsa.
Boschas fera.
—— crecca (Amer.).
—— discors.
—— discors occident.
Dafila caudacuta.
Chauliodus streperus.
Anas clypeata.
Mareca americana.
Anas ? fistularis.

Fuligulinæ.

Fuligula marita.
—— cristata.
Anas ? jamaicensis.
Anas ? spinosa.
Anas ? dominica.
Podiceps cristatus.
—— auritus.

Pelecanidæ.

Pelecanus fuscus.
Tachypetes aquilus.
Phaëton æthereus.

Laridæ.

Larus atricilla.
—— argentatus.
—— parasiticus.
Sterna fuliginosa.
—— minuta.
—— stolida.
Thalassidroma pelagica.
—— Wilsonii.

Note.—I have been guilty of discourtesy to some authors by excluding species from the catalogue which are assigned to Jamaica in their works. I have never discovered them, and I must plead that they may still reward my more successful researches. I have not included St. Domingo (Haiti) in my list, as I have no local knowledge of its ornithology, but from the writings of Vieillot it appears more extensive than either Cuba or Jamaica.

Regarding an ornithological province as a portion of the earth containing in it a greater number of land species peculiar to, and not extending beyond it, than of those common to it and adjoining countries, it may be asked—Are the greater Antilles a distinct ornithological province, or merely a portion of that of Mexico or the United States?

There are however curious differences in the birds of the several West Indian islands. Trinidad has a diversified ornithology, apparently identical with the South American continent. Many of the pigeons, woodpeckers and humming-birds differ. The *Columba carolin.* extends to Cuba and Haiti, but not to Jamaica. The *Col. Caribbæa* appears confined to the latter. The *Lampornis mango* of Jamaica is represented in Haiti by *gramineus*. There appears in the former island only one woodpecker, the *Picus carolin.*, while in Cuba

and Haiti there are several. Geological researches may assist the explanation of these anomalies. There are three mountain-ranges of different date and vegetation. One of these constitutes the Bahamas, north side of Haiti and Cuba: the Cibao range, covered with pathless forests of *Pinus occidentalis*, re-appears in Cuba and the Isle of Pines, terminating in Mexico. The precipitous mountains of the Grand Anse are formed of limestone, which is prolonged through Jamaica into Yucatan, covered with its peculiar production, *Myrtus Pimenta*, equally remarkable for its individual beauty and fragrance.

"Pauca hæc vidimus operum Dei."

April 13.—William Yarrell, Esq., Vice-President, in the Chair.

The following communication was read:—

Some Observations on the Skull of Phascolomys Vombatus. By J. E. Gray, Esq., F.R.S. etc. etc.

In the collection at the British Museum there are three skulls which agree with Prof. Owen's character of *Phascolomys Vombatus*, as described in vol. iii. of the Zool. Soc. Transactions: that is to say, they have only slightly curved upper cutting teeth, short noses, &c. Two were sent from Van Diemen's Land by Mr. Ronald Gunn, and one from N. S. Wales was presented by my late friend and admirable botanist, Mr. Allan Cunningham, F.L.S.

The specimens from Van Diemen's Land are much smaller (the largest being 6 in. 4 lines long), and more depressed and truncated behind, and have two moderate-sized oblong holes in the hinder part of the palate. The specimen from N. S. Wales is one inch longer, and has two large triangular holes in the end of the palate. All the three specimens differ in the size of the teeth, and especially in the size and relative position of the upper cutting teeth.

1. The least of the Van Diemen's Land skulls has rather small grinders, but the upper cutting teeth are small, compressed, rather diverging from each other, forming an angle in front and only touching each other at the truncated inner edge. The crowns of these teeth are 5 lines long and $2\frac{1}{2}$ lines wide. The lower cutting teeth are small with a roundish crown.

2. The other Van Diemen's Land skull, which is rather larger in all its measurements, has larger grinders. The cutting teeth are much larger: the upper large, oblong, diverging from each other, forming together a segment of a circle in front, and only touching each other by the inner edge. The crowns of these teeth are $5\frac{1}{2}$ lines long and $3\frac{1}{2}$ lines wide.

3. The skull from N. S. Wales has the teeth very like those of the small Van Diemen's Land specimen, but rather larger: the upper cutting teeth are considerably larger and rather more triangular, but in the same angular position.

It is desirable that more of these skulls should be compared, to determine whether these are only individual variations, or that there

are more than one species confounded under this name. I am inclined to the former view; but if this is the case, it shows that the skulls and teeth do not present such good specific characters as many zoologists are willing to believe.

MISCELLANEOUS.

MONSTROUS ROSES *.

Now that the spring is advancing, and nature is about to repeat the marvellous processes, which, when they are deranged by any circumstances, produce what we call monstrous flowers, we are anxious to prepare our readers to watch such phænomena by again directing them to the theory of morphology, taking for illustration the curious changes which were observed everywhere last year in the condition of the Rose. To the amateur they were a source of mortification, and to the unlearned observer, of wonder; but to the botanist, of admiration. The first deplored the deformity of his favourite flowers, without suspecting that it tended to elucidate one of the most curious points in their structure; the second puzzled himself in vain attempts to comprehend how Roses should grow out of Roses, or leaves and branches spring up from flowers; the third seized the evidence, weighed it, compared it with other evidence, and saw that it formed the most beautiful explanation of the means by which the great Author of Nature has provided plants with the means of perpetuating their race.

Linnæus taught, and Goethe proved, that all flowers are but arrangements of altered leaves. The one thought that their birth was anticipated in order to obtain the means of building up the blossom; the other demonstrated, that although the fanciful doctrine of anticipation was unsupported by evidence, yet that the blossom was really formed, in all its parts, by leaves in what a chemist would call a nascent state.

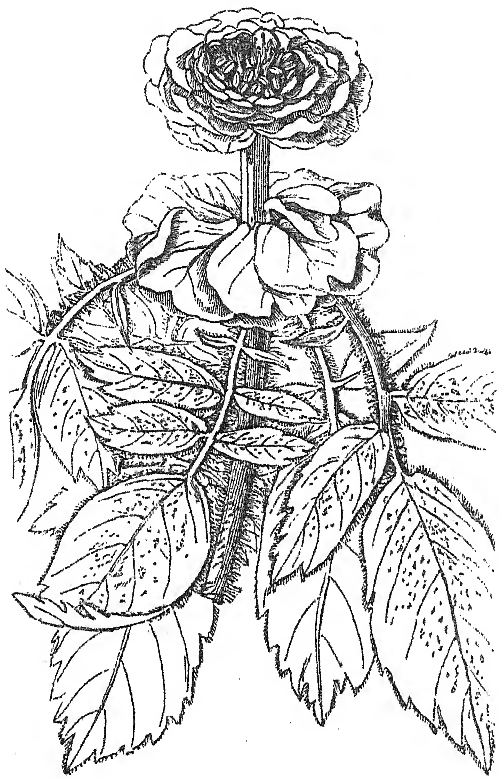
Goethe thus laid the foundation of the modern school of structural botany; and if his successors have worked out his ideas, and applied them to all cases in all plants, they have done no more. It is now known that a flower is analogous to a leaf-bud, consisting of scales within scales, packed with the most admirable method; that in its ordinary condition nature moulds these flower-scales to particular purposes, and stamps them with new attributes; but that if the cosmic forces which regulate and determine customary development are interfered with, these scales resume more or less completely their original quality, and become leaves. Hence it follows, that in cases of disturbed organization a flower extends its centre into a

* This article is reprinted from the 'Gardeners' Chronicle' for March 13, 1847, and the Editors are indebted to the kindness of Dr. Lindley for the loan of the woodcuts illustrating these remarkable monstrosities.

branch, clothed either with common leaves or with transition organs, just as a leaf-bud when called into existence pushes onwards into a branch, the only covering of which consists of leaves in their common state. An attention to this principle will always enable the observer to comprehend the real history of the monstrous formations to which flowers are most especially liable.

From among the many cases of this nature which have been brought under our notice within the last few months, we select for illustration one for which we are indebted to Dr. Bell Salter of Ryde, along with some valuable observations in illustration of it. Some time in July last this gentleman wrote as follows :—

" An extremely curious monstrosity of a Rose has been recently shown me, which exhibits some facts which I have thought might

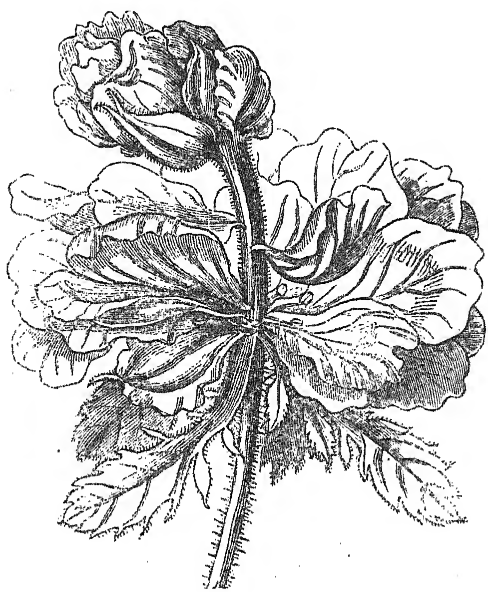


interest some of your readers, as they have interested myself. The fact of the stigmas in Roses becoming leafy has of late been only too

often observed by amateur cultivators; that formations of this kind vary in degree, there being, in some instances, only a few imperfect leaves in the centre of the Rose; while in others a distinct stem passes through, bearing a second flower. The present instance was shown me as one of this kind, but on examining it I found a quite different and much more interesting condition of the parts. The calyx had been converted into an involucre of foliaceous bracts; immediately within them were a considerable number of petals, from the centre of which rose a portion of the axis or torus to the height of $1\frac{1}{2}$ inch. At the lower part of this central stem one or two petals were inserted above the rest, but the remainder was bare of any of the ordinary parts of the flowers and clothed with a few mossy setæ: it was woody in its texture, and contained no germens. On the summit there was no recommencement of a new flower by a fresh calyx, but only the continuation of the former flower, there being petals, stamens and pistils, none of which were inserted in a calyx, one of the very characters of its class, whether considered by the Linnæan or natural system of botany—but on an expanded receptacle. Though thus altered in position, all the parts of the flower being perfect, there is no reason why this flower should not have matured its seed. It was in every respect a perfect flower, though an abnormal one. The points of interest in many monstrosities consist in the analogies which the altered parts exhibit to the normal and usual condition of the same parts in other species, or even sometimes in other classes; and this is peculiarly the case in the present instance. It has often struck me that in Rosaceous plants, the *Roseæ* are merely inverted *Dryadeæ*,—*Dryadeæ*, as it were, turned inside out, —the urceolate, so-called calyx of the Roses being rather a concave torus or receptacle; while in the *Dryadeæ*, as *Potentilla* and Strawberry, this part is convex! The same comparison may be made in the Urticaceous plants, between the *Artocarpeæ* and *Urticeæ*, the former being as the latter inverted. To cite a familiar comparison, the Fig may be said to bear the same relation to the Mulberry which the Rose does to the Blackberry. In the present instance, we have the Rose brought in some respects very nearly to the condition of the *Potentilla* and *Geum*, the numerous germens being inserted into an expanded and raised receptacle, and even exhibiting a still nearer resemblance to one species of *Geum*—the *G. rivale*, in which a part of the floral axis is elongated in the centre of the flower, forming a short stem, which is clothed as the peduncle. The most interesting consideration of all, however, in the specimen under notice, lies in the wide removal of the stamens from the calyx, thus artificially removing our Rose from the Calyciflora to the Thalamifloræ; indeed, the near approximation of the parts of fructification to their condition in the genus *Anemone* is very remarkable. The whorl of foliaceous calyx answers precisely to the involucre of leafy bracts in that genus, which, comparing it with its near congener *Ranunculus* in the same family (*Ranunculaceæ*), may be considered as the outer perianth or calyx removed from the rest of the floral whorls. From

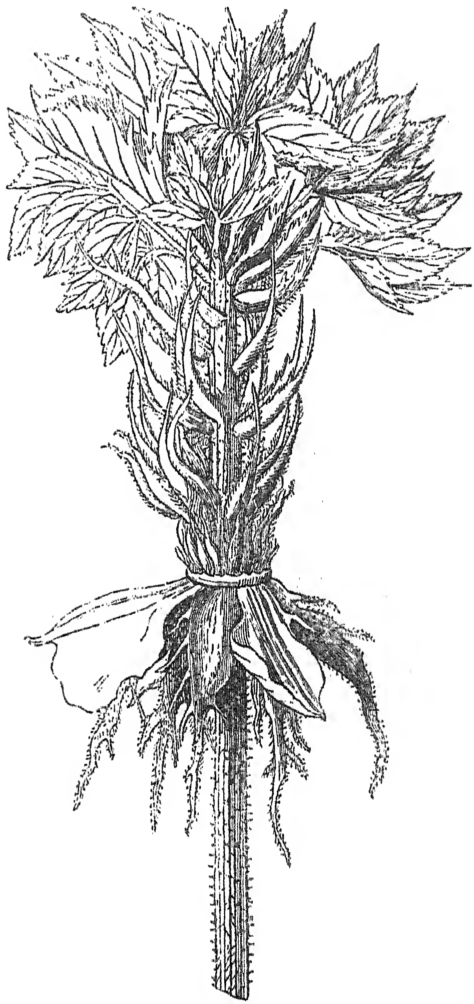
the centre of this part in our Rose—as in *Anemone*—we have a stem, with the ordinary clothing of a peduncle, bearing the essential parts of the flower; the only difference being, that in this monstrosity a part of the petals were in proximity with the involucre or altered calyx. To continue the comparison, the stamens are inserted, not on a calyx, but on a receptacle or torus; while the pistils, not being confined as they commonly are in Roses, by the contracted disc of the so-called calyx, spread abroad their hairy stigmas, very much as is seen in the *Anemone*."

A similar monster, in which the so-called tube of the calyx was quite absorbed, while the sepals became half-formed leaves, the petals half-formed sepals, the stamens half-formed petals, and the centre pushed upwards into a new Rose, whose calyx-tube was equally deficient, occurred in our own garden, and is the subject of the following illustration.



A third, for which we were indebted to a Hampstead Subscriber, was more remarkable still. In this instance the calyx-tube was again absorbed, or at least not manifest; the sepals were half converted into leaves; the petals even more than half changed into sepals; the stamens had fallen off, but appeared to have undergone little change; the exterior carpels were partly in their customary state; those nearer the centre were converted into small leaves; but the remainder were carried up upon the axis or centre, which had lengthened into a branch, in every conceivable state of transition, until the last, that

is to say the uppermost, assumed the customary appearance of the leaves of the stem.



We can conceive nothing more conclusive than this. Even if the doctrine of morphology had no other evidence than this to rely upon, we can hardly understand how a man with a logical mind could fail to give it his unqualified assent.

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